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Land-use Planning Recommendations

Adaptation Strategies for a Changing Climate in Ho Chi Minh City, Vietnam:

Summary for Decision-Makers

Upon request of the Planning Division, Department of Natural Resources and Environment Ho Chi Minh City

December 2012

Impressum

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Supplementary material can be found in "Land-use Planning Recommendations—Adaptation Strategies to a Changing Climate in Ho Chi Minh City Vietnam: Assessment Methodologies" (ISBN 978-3-3-940471-16-1). Referenced within this document as LUPR.

Photograph taken from District 1 overlooking the planned site of the new CBD in District 2

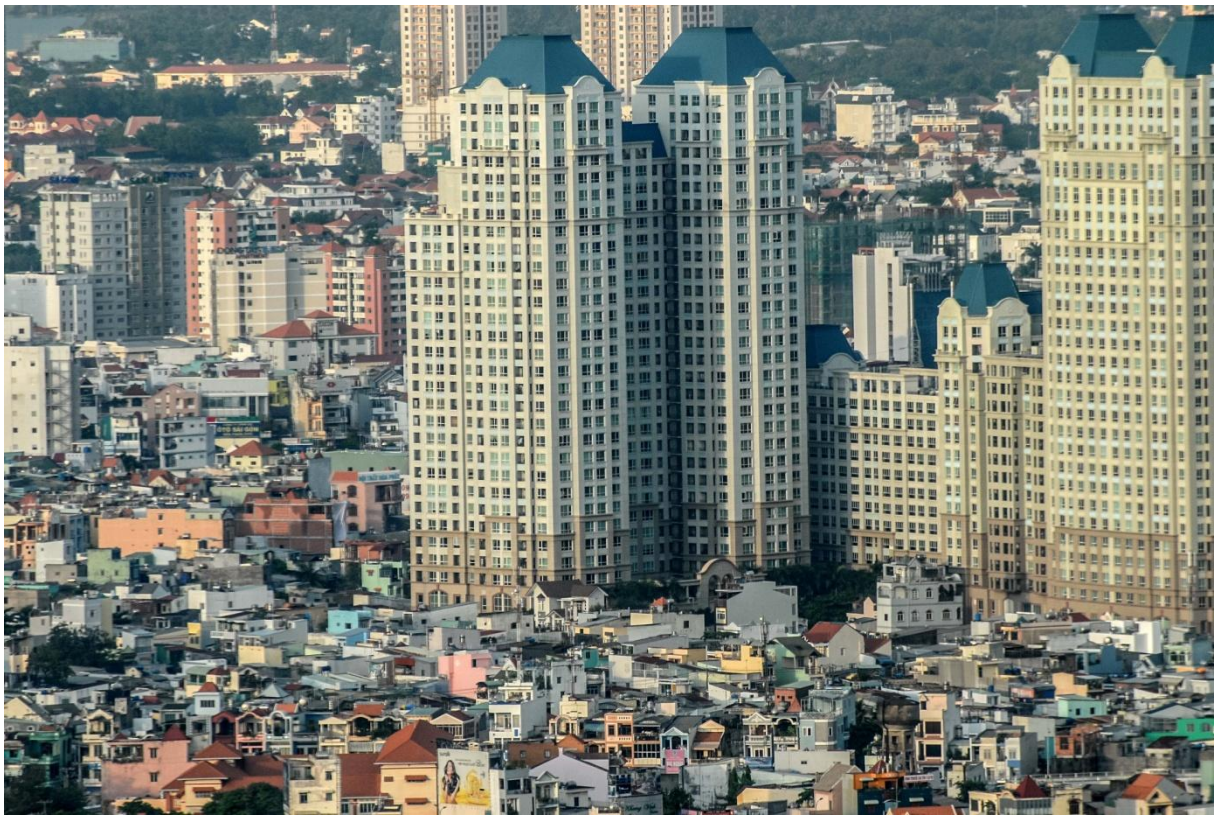
Contents

Introducing the Recommendations

Urbanisation is an extreme case of land-use change. The geographical patterns of urban expansion of a city have a direct relationship with its environmental quality, particularly water flows, flooding and urban thermal stress. A key question for urban policy and planning is how to direct these changes in ways that minimise environmental impacts and risks. Since many of the main impacts of climate change in Ho Chi Minh City additionally exhibit a land use dimension, such as the increased frequency of urban flooding events or the intensification of the already existing urban heat island effect, land-use planning and land-use controls can be seen as the most appropriate adaptation management strategy.

These recommendations have been developed under the German Ministry for Education and Research Funded research project ‘‘Integrative Urban and Environmental Planning for Adaptation of Ho Chi Minh City to Climate Change” which is funded as part of the research programme ‘‘Sustainable Development of the Megacities of Tomorrow’’ by the German Federal Ministry of Education and Research (BMBF) in close cooperation with the Department of Nature Resources and Environment, Ho Chi Minh City.

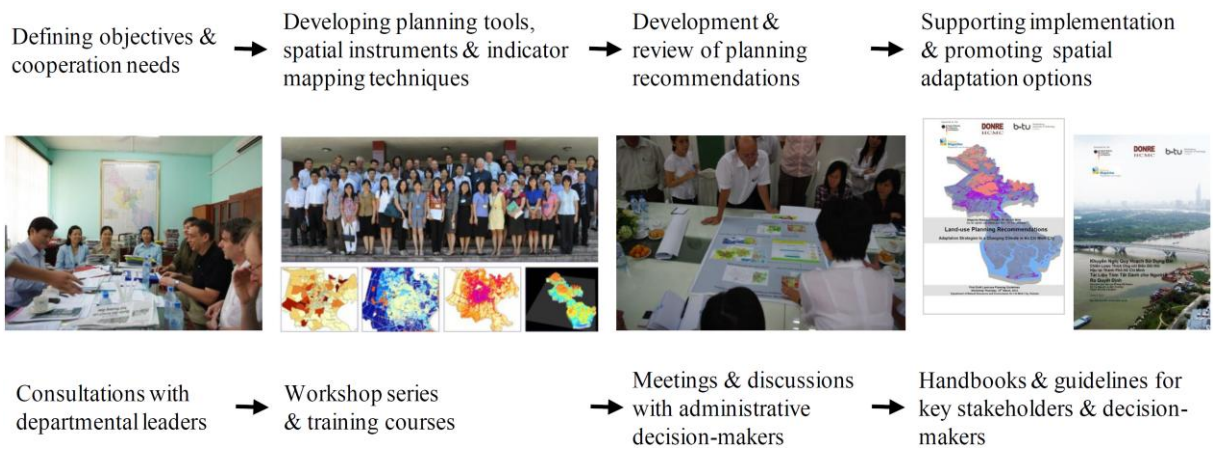
The main objective was to respond to the needs of the Department of Nature Resource and Environment, Ho Chi Minh City by providing guidance and recommendations that can be used by land-use planners and policy makers to reduce the potential adverse effects of both urbanisation and the current and future effects of climate change. The recommendations have been compiled as a stand-alone document that can be read and understood on their own, however they also contain references to the additional document entitled “Land-use Planning Recommendations—Adaptation Strategies to a Changing Climate in Ho Chi Minh City” referenced within this document as LUPR.Eleven specific focus areas were selected (labelledfrom A to K) in combination with the Department of Natural Resources and Environment. For each area the current situation is described and detailed planning recommendations are provided.



Photograph of Binh Thanh district

Cooperation and Joint Research Activities with the Department of Natural Resources and Environment, Ho Chi Minh City in the Development and Implementations of Planning Recommendations for Adapting Ho Chi Minh City´s Land-use Plan to Climate Change

Date	Event
Oct. 2008	– "Starter Forum" at Sub-Institute of Hydrology, Meteorology and Environment (SIHYMETE), HCMC
Mar. 2009	– "Berlin Environmental Atlas and its Role for the Integration of Environments Aspects into the Planning Process" Workshop at Department of Natural Resources and Environment (DONRE) HCMC – "Project Forum Adapting HCMC to the Impacts of Climate Change" and "1st Megacity Conference" at Sub-Institute of Hydrology, Meteorology and Environment (SIHYMETE), HCMC
Mar. 2010	– "Land-use and Urban Development Planning in HCMC – Adaptation Strategies" at Department of Natural Resources and Environment (DONRE) HCMC
Mar. 2011	– "Roundtable Urban Water Balance, Urban Flooding and Urban Climate" at Department of Natural Resources and Environment (DONRE) HCMC – "Workshop Sustainable Urban Development in the Times of Climate Change at Sub-Institute of Hydrology, Meteorology and Environment (SIHYMETE), HCMC
Jun. 2011	– "Reality Check: HCMC" Session at ICLEI 2nd World Congress on Cities and Adaptation to Climate Change, Bonn
Mar. 2012	– "Adaptation Strategies to a Changing Climate in HCMC- Development of Land-use Planning Recommendations" Workshop
Oct 2012	– Roundtable meeting series with the Department of Natural Resources and Environment (DORNE) and land-use planning consultants from Sub-National Institute of Agricultural Planning and Projection (Sub-NIAPP) HCMC
Dec 2012	– Megacity Research Dialogue Ho Chi Minh City: Planning for a Changing Climate Conference and Workshop "Spatial Planning in Climate Change -Towards an Integrated Framework for Adaptation"



0. Summary of Planning Recommendations for the Land-use Plan 2020

In the following for each focus area detailed planning recommendations have been developed as agreed upon in the October meeting with the Planning Division of DONRE.

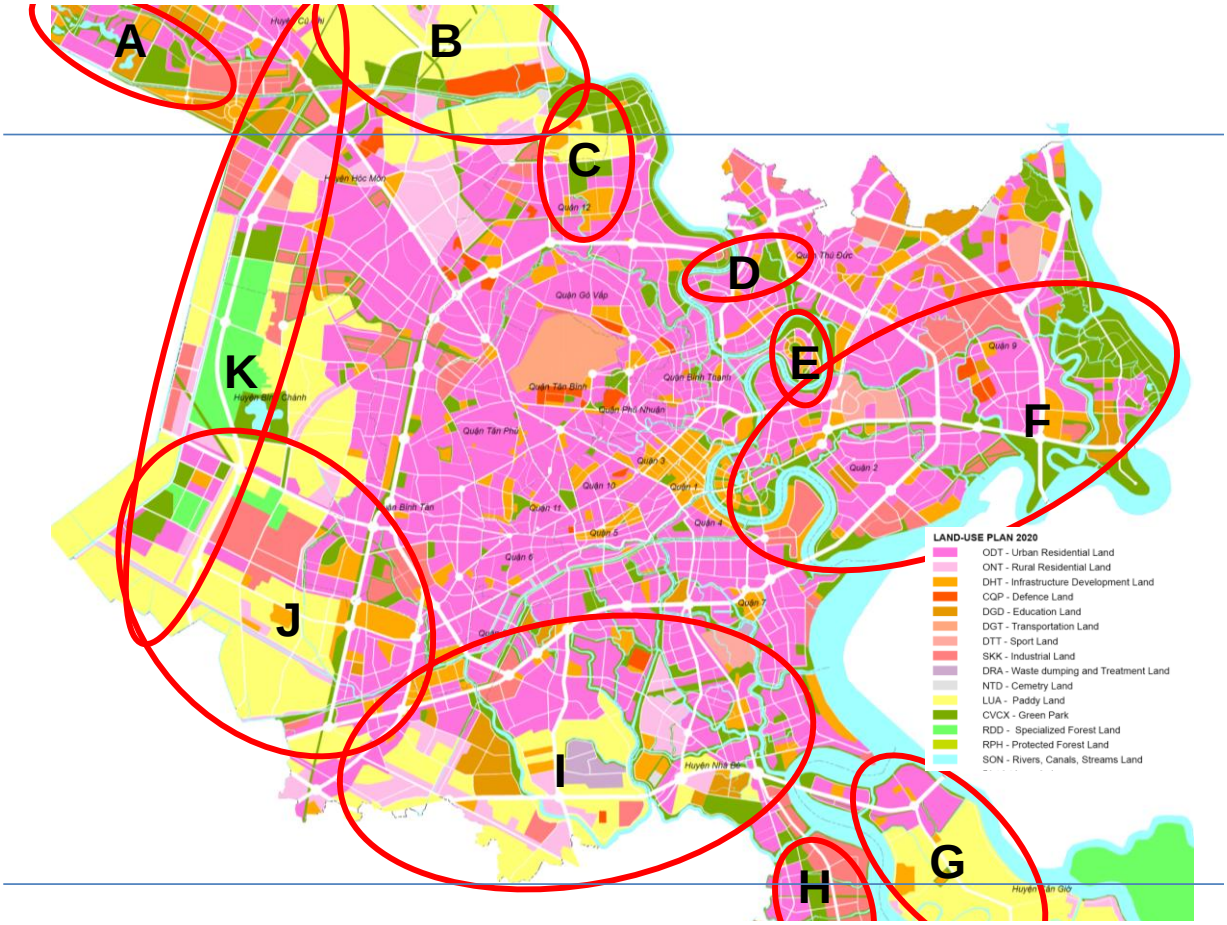


Figure 0.1: LUP 2020 (Version November 2012) and the defined focus areas for the development of comprehensive planning recommendations.

***Focus Area:* A**	**1. General Description**
Location	
District	– Cu Chi
Communes	– Tan An Hoi, Tan Thong Hoi, and Tan Phu Trung
Current Land-use	
Current Situation	– Urbanisation mixed use with small vegetable production. Strongest urbanised area of Cu Chi district.
Built-up Densities (on-site)	– Over 50% of the area is non-residential, population densities are very low (2.1). – The other main land-use of significance is industry (1.1). – The area contains currently very few buildings (2.2) and an extremely low ground coverage ratio <0.05 (2.3.2). – The current available floor space (2.3) and floor area ratios are low (2.3.1) respectively. – Overall soil sealing rates are low (2.5).
Built-up Densities (neighbouring areas)	– To the northern edge of the area, population (2.1), built-up ratio (2.3), and building volume (2.4) densities are seen to increase moderate levels. – Soil sealing rates increase in higher lying wards to the north and east (Thi Tran Cu Chi, Xa Phuoc Vinh An and Xa Tan Phu Trung).
Construction Activities	– Construction activities are seen in the current industrial area to the east of the area (1.2).
Green & Open Spaces and Agriculture	– The vast majority of the area is non-built up and currently being used for agriculture purposes (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Urbanised area in the North West, solid waste management, industrial land, universities, chemistry-pharmaceutical industry, etc. This area will change almost 100% from agricultural to non-agricultural land.
Remaining Share of Green & Open Spaces, Agriculture	– A share of the land has been zoned to include open green and blue features in the draft land-use plan 2025 (1.3). – Estimated remaining share of open and green space= 25%.

Focus Area: **A**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average Elevations range from 1.5 meters to <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– This area is affected by stormwater accumulation from adjacent higher-elevated built-up land (to the north, Thi Tran Cu Chi and Phuoc Vinh An). – To the north and east of the area only a small proportion of the current built up land on the periphery of the area is below 1.5 meters AMSL.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will take place in areas currently below the 1.5 meters AMSL.
Planning Recommendations	– The remaining open-spaces should be interconnected and optimised for water-retention. – The planned small lakes and green spaces surrounding the new industrial areas should - where possible – be relocated to areas below 0.5 meters AMSL.
Stormwater	
Current Situation	– Practically no surface runoff is generated from this area (2.6). – Surface runoff accumulation site for adjacent higher-elevated built-up areas (see to the north, Thi Tran Cu Chi and Phuoc Vinh An).
Protection Needs	– Protect the existing near-natural water balance of un-built up land.
Expected Changes	– Estimated remaining share of open and green space= 25%. – Medium to high surface runoff will be generated following realisation of LUP depending upon sealing degree. – Only within the park areas can a semi-natural water balance can be obtained.
Future Risk	– The risk of urban flooding due to urbanisation will increase sharply.
Planning Recommendations	– Increase the share of green areas. – Focus: Low-lying areas on the edge of slopes.
Urban Climate	
Current Situation (3.3.1)	– Zone 1: Open areas with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas. – Zone 2: Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone A: Well-ventilated zone by southeasterly winds**.** Good ventilation and cooling effects for adjacent settlements, decreasing towards the denser inner city districts.
Expected Changes and Future Risk	– Fresh air production is hampered. – The reduced air flow will increase urban heat load in easterly settlements.
Planning Recommendations	– Climate sensitive areas for fresh air production. – New developments require site-specific climate assessment, to ensure the protection of ventilation paths.

Focus Area: **A**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits important functions for stormwater management and urban climate regulation, particularly for adjacent settlement areas. Low-lying land (below 1.5 m AMSL) is at high-risk of flooding and accumulates stormwater from the higher elevated residential areas of Cu Chi District. – The LUP2020 zones currently un-built up land to new “Industrial Land” (code SKK) and “Urban Residential Areas” (code ODT). – This is in conflict with our assessments, because important air movements are reduced and blocked (urban climate), surface runoff will increase sharply (storm water management) and there is high risk of inundation (flood risk). – The LUP2020 is zoning the remaining un-built up areas generally as “Green Park Area” (code CVCX) including some smaller artificial lakes. This zoning is supported by our assessments, and should be enforced within the final version of LUP2020. – It is recommended to reduce the zoning of new developments (ODT & SKK) and to increase the share of open spaces (CVCX), in order to maintain the ventilation corridors and additionally increase the area available for effective stormwater management. The planned small lakes and green spaces (CVCX) surrounding the new developments (ODT & SKK) should, wherever possible, be relocated to areas below 0.5 meters AMSL.

Focus Area: **B**	**1. General Description**
Location	
District	– Cu Chi
Communes	– Hoa Phu, Tan Thanh Dong, and Binh My
Land-use	
Current Situation	– Mainly agriculture and aquaculture area.
Built-up Densities (on-site)	– Over 50% of the area is non-residential (1.1), as such population densities are low (2.1). Residential areas are concentrated in Xa Dong Thanh. – The predominant land-use is agriculture. Other land-uses include residential, industrial and waste treatment facilities (1.1). – The focus area contains currently only a very small amount of individual buildings (2.2). Buildings, building volumes (2.4) and built up densities increase towards the southern edge of the area (2.2). – Overall the area has very low ground coverage ratios (2.3.2). – Floor space and floor area coverage are low (2.3 & 2.3.1). – Overall soil sealing rates are mainly low at 0-10% (2.5), however increase southwards.
Built-up Densities (neighbouring areas)	– To the southern edge of the area, population (2.1), built-up ratio (2.3), building volume (2.4) densities and soil sealing rates (2.5) are seen to increase to moderate levels.
Construction Activities	– Minimal construction activities are seen in the centre of the area, close to Xa Tan Thanh Dong (1.2).
Green & Open Spaces and Agriculture	– The vast majority of the area is non-built up and currently being used for agriculture purposes (1.1).
Land-use Plan 2020	
Planned Changes *(provided by DONRE)*	– Planed to be river-eco-tourism area: – 1,500ha rice plantation area (Binh My & Tan Thanh Dong); – Eco-tourism area (Tan Thanh Dong); – National security area to the South of Belt Road 3.
Remaining Share of Green & Open Spaces, Agriculture	– A substantial proportion of the land has been zoned to include open green and blue features in the draft land-use plan 2025 (1.3). For example a large green riparian corridor along the Tra Canal. – Estimated remaining share of open and green space= 80%.

Focus Area: **B**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.5 meters to <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– This area is affected by stormwater accumulation from adjacent higher-elevated built-up land (Hoc Mon district communes, Xa Hoa Phu, Xa Tan Hiep, Xa Thoi Tam Thon and Thi Tran). – The eastern part (Xa Binh My) of the area is affected by flooding caused by high-tide from the Saigon River. – In the centre of the area only a few houses or smaller settlements are located below 1.5 meters AMSL.
Future Risk (1.3.new, 2.2, 3.1.1)	– No further conflicts: No residential or industrial areas are planned. – New buildings (eco-tourism area) will require flood-proofing measures.
Planning Recommendations	– This area is important for water retention of the adjacent southern lying settlement areas in Hoc Mon District.
Stormwater	
Current Situation	– Only modest surface runoff amounts are generated from this area (2.6). – Surface runoff accumulation site for adjacent higher-elevated built-up areas (Hoc Mon District communes, Xa Hoa Phu, Xa Tan Hiep, Xa Thoi Tam Thon and Thi Tran Hoc Mon).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1).
Expected Changes	– Estimated remaining share of open and green-space= 80%. – Status of surface runoff will not change dramatically.
Future Risk	– The risk of urban flooding due to urbanisation will not increase.
Planning Recommendations	– No change of uses in LUP required. – No further recommendations for LUP required.
Urban Climate	
Current Situation (3.3.1)	– Zone 1: Open areas with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas. – Zone 2: Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone A:Well-ventilated zone by southeasterly winds. Good ventilation and cooling effects for adjacent settlements, decreasing towards the denser inner city districts.
Expected Changes and Future Risk	– As high share of green and open land is maintained, no adverse effect to urban climate.
Planning Recommendations	– Climate sensitive areas for fresh air production, – Advection towards settlements should be respected, – Agricultural land should be protected, the eco-tourism area should be kept open.

Focus Area: **B**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits important functions for stormwater management and urban climate, particularly for adjacent settlement areas. – The LUP2020 zones all un-built areas as “Agricultural Land” (code LUA) and “Eco-Tourism Area” (code CVCX). – The zoning in LUP2020 is supported by our assessments and should be enforced in the final version of LUP2020.

Focus Area: **C**	**1. General Description**
Location	
District	– Hoc Mon, District 12, Go Vap
Communes	– (Hoc Mon) Xa Dong Thanh. – (District 12) Thoi An, Thanh Xuan, Thanh Loc, Tah Thoi Hiep, Tan Chanh Hiep. – (Go Vap) Phuong 13.
Land-use	
Current Situation	– Location of former landfill for HCMC. Noted high level of pollution.
Built-up Densities (on-site)	– In total, approximately 55% of the area is residential (1.1), the other major land-use is agriculture. – Non-residential and agricultural land-uses are found along the Ben Cat River corridor and in the centre of the focus area (District 2, commune Thanh Xuan) Residential land-uses encircle this area in all directions (1.1). – The majority of buildings are seen in the southwest edge of the area (Go Vap District, commune 13) (2.2). Here building volumes (2.4), floor space, coverage and floor area ratios are seen to increase (2.3; 2.3.1 & 2.3.2). – Population densities are seen to vary but do not rise above moderate levels—highest values are seen to the southwest edge (2.1). – Soil sealing rates are mainly low at 0-10% (2.5); however peak in the south-western corner of the area with levels up to 90%.
Built-up Densities (neighbouring areas)	– The area is encircled by built-up land of moderate densities. – Population and built-up densities are seen to increase southwards from this area.
Construction Activities	– Solitary construction activity to the south of the area (1.2).
Green & Open Spaces and Agriculture	– Roughly 45% the area is non-built up and currently being used for mixed agriculture purposes (1.1). Concentrating along the Ben Cat River corridor and in the centre of the focus area.
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Along the Ben Cat River there will be green area. – The remaining of Dong Thanh commune will be converted to non-agricultural land; – Existing landfill will be treated and developed into a green park; the pollution in this area will be improved.
Remaining Share of Green & Open Spaces, Agriculture	– A proportion of this area has been zoned to include open green features in the draft land-use plan 2025 (1.3). – Estimated remaining share of open and green space= 60%.

Focus Area: **C**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– The elevation of all un-built land is<0.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– Flooding by high-tide from Saigon River strongly affects this area. – The rural residential area (low-density development) in the eastern part located on the floodplains of Saigon River (below 0.5 meters AMSL) is strongly affected by tidal flooding (3.1.1).
Future Risk (1.3.new, 2.2, 3.1.1)	– All open areas (along Ben Cat River corridor) and the rural residential zone - are currently below 0.5 meters AMSL and strongly affected by the current max-tide level of 1.5 meters AMSL. – This area is affected by stormwater accumulation from adjacent higher-elevated built-up land (from the west, District 12, commune Hiep Thanh and Hoc Mon District commune Dong Thanh.
Planning Recommendations	– All open areas below the current max-tide level of 1.5 meters AMSL should be protected to avoid new developments in high-risk zones. – Additionally these open areas along the Ben Cat River corridor have an important natural function for water drainage and water retention for the adjacent higher-elevated denser residential areas in District 12. – Further densification of the rural residential area to the east of the area, which is located within the floodplains of Saigon River, should be restricted.
Stormwater	
Current Situation	– Only modest surface runoff is generated from this area (2.6). – Surface runoff accumulation site for adjacent higher-elevated built-up areas (from the west, District 12, commune Hiep Thanh and Hoc Mon District commune Dong Thanh).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 60%. – Medium surface runoff will be generated.
Future Risk	– The risk of urban flooding due to urbanisation will increase.
Planning Recommendations	– Protect the existing green areas along Ben Cat River corridor.
Urban Climate	
Current Situation (3.3.1)	– Zone 1: Open areas with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone A: Well-ventilated zone by southeasterly winds. Good ventilation and cooling effects for adjacent settlements, decreasing towards the denser inner city districts. – Zone C: West-east wind circulation zone.
Expected Changes and Future Risk	– Planned land use changes will have minimal effects on urban climate.
Planning Recommendations	– Important area for fresh air production and circulation – Protect the existing green and open areas along Ben Cat River corridor.

Focus Area: **C**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits important functions for urban climate and stormwater management and is—as a low-lying area with a mean elevation of below 0.5 meters AMSL and located within the floodplain of Saigon River—at high-risk from tidal flooding. – The zoning of un-built up land as “Agricultural Land” (code LUA) and “Green Areas” (code CVCX) in LUP2020 is supported by our assessment, and should be enforced within the final version of LUP2020. – The LUP2020 is now zoning the existing low-dense rural residential area in the floodplain along the banks of Saigon River as “Urban Residential Land” (code ODT). This zoning is in direct conflict to our assessment, as any new development should be prevented to avoid new developments being sited in the low lying, high-risk areas within the Saigon River floodplain. Additionally these open areas have important functions for water management and urban climate regulation for the adjacent higher-elevated denser residential areas in District 12. – The green riparian buffers along the banks of Saigon River– zoned as “Green Area” (code CVCX), should be enforced in the final version of the LUP2020 and where possible increased in width to avoid new developments directly on the riverbank edge.

Focus Area: **D**	**1. General Description**
Location	
District	– Thu Duc
Communes	– Hiep Binh Phuoc, Hiep Binh Chanh, Linh Dong, Troung Tho, Phuoc Long, A, Phuoc Long B, Phuoc Binh, Linh Chieu, Hiep Phu, Tam Phu
Land-use	
Current Situation	– Hiep Binh Phuoc is the low-density residential area. To the West and East, new-urban areas with the entertainment park are planned.
Built-up Densities (on-site)	– In total, approximately 60% of the area is residential the other major land-use is agriculture (1.1). – Buildings are concentrated in the middle of the area and to the east (2.2). To the left of the centre, highest building volumes are found (2.4). – Non-residential and agricultural land-uses are found to the west (Hiep Binh Phuoc) with some scattered activities to the east (Linh Chieu and Binh Tho). – In residential areas, population densities are moderate (2.1). – Moderate floor space (2.3), floor area (2.3.1) and coverage (2.3.2) ratios are highest in the centre of the focus area. – Overall soil sealing rates reach extreme levels of up to 100% in the central lying residential built-up areas of Linh Dong and Tam Phu.
Built-up Densities (neighbouring areas)	– The area is encircled by built-up land of moderate densities, mostly residential (1.1). – Population and built-up densities are highest in the adjacent areas to the northeast and southwest.
Construction Activities	– Construction activities are seen within the current central residential belt (1.2).
Green & Open Spaces and Agriculture	– The vast majority of green and open space is currently used for agricultural purposes and situated in the west of the focus area (1.1).
Land-use Plan 2020	
Planned Changes *(provided by DONRE)*	– Most of the area in Hiep Binh Phuoc will be developed to residential area (low density). – Build up dyke system along the banks to prevent flooding for Saigon River.
Remaining Share of Green & Open Spaces, Agriculture	– A large park-like structure has been zoned in the draft land-use plan 2025 to the west of the area (1.3). – Estimated remaining share of open and green space= 10-20%.

Focus Area: **D**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.0 meters to <0.5 meters AMSL. – The area contains no land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– Flooding by high-tide from the Saigon River strongly affects the area. – This area is strongly affected by stormwater accumulation from adjacent higher elevated built-up land in Thu Duc District. – All current built-up areas experience frequent flooding caused by rain and high-tide.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments, such as recently built-up land, will be confronted by frequent flooding caused by both rain and high-tide individually and in combination (3.1.1).
Planning Recommendations	– All open areas are currently below the current max-tide level of 1.5 meters AMSL. These areas should be protected to avoid new development placed at significant flood risk. – The important function of the existing open areas for water retention from adjacent settlement areas in Thu Duc District should be maintained. – The proposed dyke system along the Saigon River may increase the flood risk by accumulating stormwater in the low-lying areas behind the dyke.
Stormwater	
Current Situation	– Medium surface runoff is generated from this area (2.6). – Surface runoff accumulation site for adjacent higher elevated built-up areas (Thu Duc District, communes Tam Phu, Linh Dong and Truong Tho).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1). – Avoid further soil sealing in the low-dense built-up areas to maintain the current low runoff conditions (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 10%. – High surface runoff will be generated following realisation of LUP depending upon sealing degree.
Future Risk	– The risk of urban flooding due to urbanisation will increase sharply. – Due to the dyke system, the drainage to the Saigon River may become hindered.
Planning Recommendations	– Increase the proportion of green areas (> 80%). – Focus: low lying areas at the edge of slopes.
Urban Climate	
Current Situation (3.3.1)	– Zone 1: Open areas (western part, along the banks of Saigon River) with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas. – Zone 2: Open areas (eastern part) with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone C: West-east wind circulation zone.
Expected Changes and Future Risk	– New development will increase heat load.
Planning Recommendations	– Any new development requires site-specific climate assessment, to ensure the protection of the important west-east ventilation paths.

Focus Area: **D**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits important functions for urban climate and stormwater management and is, as a low-lying area (mainly below 1.0 meters AMSL), located within the floodplain of Saigon River and additionally an important stormwater accumulation zone for Thu Duc District, at high-risk from flooding. – The LUP2020 zones currently un-built land and existing low-dense (rural) residential areas as “Urban Residential Land” (code ODT). Only smaller areas are zoned as “Green Areas” (code CVCX). – This zoning of the “Urban Residential Land” (code ODT) is in strong conflict with our assessment, as any new developments in the low-lying areas should be prevented to avoid new developments in high-risk areas for flooding and inundation. Additionally these open areas have important functions for water management and urban climate regulation for the adjacent higher-elevated and denser residential areas of Thu Duc District.

Focus Area: **E**	**1. General Description**
Location	
District	– Binh Thanh
Communes	– Binh Quoi, Thanh Da, Commune 28, Commune 27
Land-use	
Current Situation	– Binh Quoi eco-tourism area.
Built-up Densities (on-site)	– As over 50% of the area is non-residential, population densities are relatively low (2.1). – The area contains very few buildings (2.2) and as such soil sealing rates (2.5) and current floor space is low (2.3). Soil sealing and floor space increase in the northern edge (2.1). – Highest population and built up densities are seen on the northern edge of the area (2.1; 2.2; 2.3; 2.3.1 & 2.3.2). – Over 50% of the area is non-residential, population densities are low (2.1). – The other main land-use of significance is industry (1.1). – The area contains currently very few buildings (2.2) and an extremely low ground coverage ratio <0.05 (2.3.2). – The current available floor space (2.3) and floor area ratios are low (2.3.1) respectively. Overall soil sealing rates are low (2.5).
Built-up Densities (neighbouring areas)	– The area is encircled on three sides by the Saigon River and beyond built-up land of moderate densities to the West.
Construction Activities	– No construction sites are noted (1.2).
Green & Open Spaces and Agriculture	– The vast majority of the area is non-built up and currently being used for tourism purposes (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Will build up dyke system around Thanh Da peninsula. – Binh Quoi eco-tourism area with higher green coverage.
Remaining Share of Green & Open Spaces, Agriculture	– A large section of the land has been zoned for development. A green riparian zone on the eastern bank of the Saigon River is designated in the draft land-use plan 2025 (1.3). – Estimated remaining share of open and green space= 40%.

Focus Area: **E**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.0 meters to<0.5 meters AMSL. – The area contains no land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– As low-elevated peninsula at the banks of Saigon River, flooding caused by high-tide strongly affects this area.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will be confronted by frequent flooding caused by high-tide (3.1.1).
Planning Recommendations	– All open areas of the Binh Quoi eco-tourism area are currently below the current max-tide level of 1.5 meters AMSL and as such should be protected to avoid new developments which would be at a significant risk of flooding. – The proposed dyke system at Saigon River would increase the pressure on the densification of eco-tourism area for urban development.
Stormwater	
Current Situation	– Only little surface runoff is generated from this area (2.6).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 40%.
Future Risk	– The risk of urban flooding due to urbanisation will probably increase. – Due to the dyke system the drainage to Saigon River may become hindered.
Planning Recommendations	– Strict regulations for runoff control within the area.
Urban Climate	
Current Situation (3.3.1)	– Zone 2: Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas. – Zone 3: Strong daily variation through incoming radiation, but good cooling effect.
Current Ventilation Characteristics (3.3.1)	– Zone C: West-east wind circulation zone.
Expected Changes and Future Risk	– No sufficient changes for urban climate expected.
Planning Recommendations	– Moderate land-use change possible, yet intensive urban development should be avoided.

Focus Area: **E**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits very significant functions as a park and green area for the inner districts and is, as low-lying area (mainly below 1.5 meters AMSL) located within the floodplain of Saigon River at high-risk of tidal flooding. – The LUP2020 zones currently un-built land as “Urban Residential Land” (code ODT) placing development pressure upon the eco-tourism area and the green riparian buffers along the riverbanks zoned as “Green Area” (code CVCX). – This zoning of “Urban Residential Land” (code ODT) is in strong conflict to our assessment, as any new developments in this low-lying area should be prevented to avoid new developments in these high-risk areas for tidal flooding.

Focus Area: **F**	**1. General Description**
Location	
District	– District 2 (West) and District 9 (East)
Communes	– (District 2): An Phu, An Khanh, Thu Thiem, An Loi Dong, Binh An, Binh Trung Tay, Binh Trung>Dong, Thanh My Loi, Cat Lai, Phuoc Binh. – (District 9): Huu Phu, Long Truong, Long Phuoc, Truong Thanh.
Land-use	
Current Situation	– Former agricultural area. An Phu of District 2 is urban area with almost entirely villa development.
Built-up Densities (on-site)	– Approximately 33% of the area is residentially built-up (1.1) with varying densities. – Population densities are generally very low (2.1), with the exception of Phuoc Binh and Phuoc Long where population density is seen to at its highest for this area. This corresponds with the highest concentration of individual buildings (2.2). – The other main land-use of significance is agriculture (1.1). – Building volumes (2.4) are highest in Phu Huu. – Floor spaces (2.3), coverage (2.3.2) and floor area ratios are highest in Phuoc Binh and Phuoc Long as well as at the terminal south of Cat Lai. Overall soil sealing rates vary highly. Highest values are seen in Phuoc Binh and Phuoc Long as well as at the terminal south of Cat Lai (2.5).
Built-up Densities (neighbouring areas)	– The area is bordered by the Saigon River to the West and the Dong Nai River to the South and East. – On its northern periphery, the area bordered by moderately dense developments.
Construction Activities	– A large proportion of this area is under construction activities (1.2).
Green & Open Spaces and Agriculture	– Roughly one third of the area is currently non-built up and being used for agriculture purposes. A further third is currently under some form of construction (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Former agricultural area of around 4,900 ha in District 2 and 9, 1,000 ha of cash crop will be kept, the rest will be converted to non-agricultural land: – This will be urbanised area of technology-science, one of four satellite centres of HCMC: – Residential area (low density), universities (District 9). – Belt Roads 2 & 3 will pass through this area. – Dyke system for Dong Nai River.
Remaining Share of Green & Open Spaces, Agriculture	– A large proportion has been zoned for development in the land-use plan 2025 (1.3). – Estimated remaining share of open and green space= 20%.

Focus Area: **F**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average Elevations range from 1.0 meters <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL (1.4). – Currently almost all built-up areas are above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– Currently all un-built up land is located in the floodplain of Dong Nai River and flooding caused by high-tide strongly affects this area. – The northern parts of this area are affected by stormwater accumulation from the adjacent higher-elevated and built-up land of Thu Duc District.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will be confronted by frequent flooding caused by high-tide. – New developments adjacent to the higher-elevated built-up areas of Thu Duc District will be confronted by frequent flooding caused by stormwater accumulation.
Planning Recommendations	– The required land for the proposed dyke system along the Dong Nai River is not visibly zoned in the LUP 2020. Here clear zoning is required to avoid improper urban development and costly relocation or resettlement in the future. – The green riparian buffers along the banks of the Dong Nai River and the connected smaller rivers and canals should be explicitly zoned and increased in width. – At the edge to higher-elevated denser built-up areas of Thu Duc District more interconnected open and green spaces are required for water retention and storage. – All new developments below the current max-tide level of 1.5 meters AMSL are at high-risk for tidal flooding. New developments in this area are only possible with an established clear and holistic flood and water management strategy for the whole area.
Stormwater	
Current Situation	– Minor surface runoff is generated from some parts of this area (2.6). – Surface runoff accumulation site for adjacent higher-elevated built-up areas of Thu Duc District.
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1). – Avoid further soil sealing in the low-dense built-up areas to maintain the current low runoff conditions (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 20%. – The area is drained and incised by large number of canals and natural small rivers, which face alteration and modification from the planned development activities (2.2). – High surface runoff will be generated following realisation of LUP depending on sealing degree.
Future Risk	– The risk of urban flooding due to urbanisation will increase sharply.
Planning Recommendations	– Increase the proportion of green areas (>50%). – Focus: low lying areas on the border to the slopes (Thu Duc District communes, Truong Thanh, Phuoc Binh and Phuoc Long and along the river bank of the Dong Nai River to the south).

Urban Climate	
Current Situation (3.3.1)	– Zone 2: (Dominant) Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas. – Zone 1: (Mouth of the Tac River into Dong Nai River) Open areas with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone V: (Dominant) Ventilation zone. Monsoon winds in northeast and southwest direction. – Zone C: (Northern border to Thu Duc District) West-east wind circulation zone.
Expected Changes and Future Risk	– Increased heat load. – The fresh air movement is disturbed.
Planning Recommendations	– High sensitivity with respect to existing circulation pattern. – A 50% share of green and open space should be maintained. – Any new development requires site-specific climate assessment, to ensure the protection of the important north-easterly ventilation paths.

Focus Area: **F**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area displays very important functions for the urban climate regulation of adjacent settlement areas (including high-dense developments in District 1 and 2) and for stormwater management (including Thu Duc District). Additionally, as low-lying area (mainly below 1.0 meters AMSL) located within the floodplain of Dong Nai River the area is at high-risk from tidal flooding. – The zoning of un-built up land as “Green Park” and “Eco-Tourism Areas” (code CVCX) in the LUP2020 is supported by our assessment, and should be enforced and extended to include further un-built land within this area in the final version of LUP2020. – The LUP2020 rezones more than 80% of the existing agricultural land to “Residential Land” (code ODT) and partly as “Industrial Land” (code SKK) or “Infrastructure Development Land “ (code DHT). – This zoning is in conflict to our assessment, because new developments in low-lying areas should be prevented to avoid new developments in the floodplain of Dong Nai River. Additionally these open areas have important functions for water management and urban climate regulation for the adjacent high-dense settlement areas of District 1 & 2 and Thu Duc District. – For urban climate and the maintenance of the important ventilation pathway, and for stormwater management, an interconnected and explicitly zoned much larger “Green Area” (CVCX) extending from the Saigon River along Rachchiec River, Trau-Trau River, Tac River to the banks of Dong Nai River is recommended. – The green riparian buffers along the banks of Dong Nai River and the connected smaller rivers and canals – zoned as “Green Area” (code CVCX) - should be enforced in the final version of the LUP2020. In particular, in District 2 green riparian buffers should be zoned for all smaller rivers and canals and increased in width to avoid new developments directly on the riverbank edge. – The required land for the proposed dyke system along Dong Nai River should be explicitly zoned in the LUP 2020. – New developments are only possible with an established clear and holistic flood & water management concept for the whole area.

Focus Area: **G**	**1. General Description**
Location	
District	– Can Gio
Communes	– Binh Khanh, An Thoi Dong
Land-use	
Current Situation	– Rural residential area, with aquaculture (shrimp, crabs, fishes, or mix with rice-fields).
Built-up Densities (on-site)	– The vast majority of the area is non-residential; population densities are very low, peaking along the Highway Rung Sac (1.1). As such, population density is low (2.1). – Aquaculture and agricultural land-uses dominate (1.1). – The area contains currently very few buildings, those which exist are concentrated along the main highway (2.2) and as such soil sealing rates (2.5) and current floor space is low (2.3). Highest soil sealing is seen only at the port terminal. Building volume (2.4), Floor area (3.2.1) and Coverage (3.2.2) ratios are low.
Built-up Densities (neighbouring areas)	– The focus area is bordered on three sides by the Long Tau and Nha Be Rivers.
Construction Activities	– No current construction activities are seen (1.2).
Green & Open Spaces and Agriculture	– The vast majority of the area is non-built up and currently being used for agriculture and Aquaculture purposes (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Rural residential area, with aquaculture (shrimp, crabs, fishes, etc.). Only moderate expansion of urban residential areas.
Remaining Share of Green & Open Spaces, Agriculture	– The current residential area is to be expanded in the draft land-use plan 2025. All other areas appear to remain the same designation (1.3). – Estimated remaining share of open and green space= 80%.

Focus Area: **G**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.5 meters to <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– Currently all un-built up land is located in the floodplain of the Long Tau and Nha Be Rivers and flooding caused by high-tide strongly affects this area. – The existing smaller settlement area in the northern part relies on flood protection measures at the building level.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will be confronted by flooding caused by high-tide.
Planning Recommendations	– The green riparian buffers along the banks of the Long Tau and Nha Be Rivers should be explicitly zoned and increased in width. – All new developments below the current max-tide level of 1.5 meters AMSL are at high-risk for tidal flooding. New developments in this area are only possible with flood protection measures at the building level. – Further expansion of the rural residential area southwards should be restricted; therefore the zoning of agricultural land is important.
Stormwater	
Current Situation	– Almost no surface runoff is generated from this area (2.6).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 80%. – Status of surface runoff will not change significantly.
Future Risk	– The risk of urban flooding due to urbanisation will not increase.
Planning Recommendations	– No change of uses in LUP required. – No further recommendations for LUP required.
Urban Climate	
Current Situation (3.3.1)	– Zone 2: Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone B: Southwest–northeast wind circulation zone. By keeping the porosity of the urban structure, the ventilation conditions for the south of the city can be maintained.
Expected Changes and Future Risk	– No changes in urban climate expected.
Planning Recommendations	– High climate sensitivity, therefore Land-use changes only allowed with openness of 50% coverage.

Focus Area: **G**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits important functions for urban climate regulation and is at high-risk of tidal flooding. – The LUP2020 accepts a slight extension of the existing low-dense residential area, now rezoned as “Urban Residential Land” (code ODT), while zoning most of the current un-built areas as “Agricultural Land” (code LUA), and thereby restricting the further expansion of residential areas into agricultural land. – The zoning of “Agricultural Land” (code LUA) in LUP2020 is supported by our assessment, and should be enforced within the final version of LUP2020. – It is appropriate that the zoning of the residential areas should be rezoned from “Urban Residential” (code ODT) to “Rural Residential” (code ONT), to ensure the required openness and reduce building densities in this highly climate sensitive and high flood-risk zone. – The green riparian buffers along the banks of the Long Tau and Nha Be Rivers – zoned as “Green Area” (code CVCX) - should be increased in width to avoid new developments on the riverbanks edge.

Focus Area: **H**	**1. General Description**
Location	
District	– Nha Be District
Communes	– Hiep Phuoc
Land-use	
Current Situation	– Residential area to the Northwest. To the North and the Southeast Hiep Phuoc Industrial zones (1 and 2).
Built-up Densities (on-site)	– The vast majority of this area is non-residential; aquaculture and agriculture land-uses dominate (1.1); current population densities are very low (2.1). – Most building are clustered alone Nguyen Van Tao Highway (2.2). – Very low soil sealing rates (2.5); current floor space is low (2.3). Highest soil sealing is seen only at the port terminal. Building volume (2.4), floor area (3.2.1) and coverage (3.2.2) ratios are low.
Built-up Densities (neighbouring areas)	– The focus area is bordered to the north by DondienRach, to the east and south by Nha Be River and to the west by Long An province.
Construction Activities	– No visible construction activities (1.2).
Green & Open Spaces and Agriculture	– Aquaculture and agriculture land-uses dominate (1.1).
Land-use Plan 2020	
Planned Changes *(provided by DONRE)*	– Residential and industrial area (Hiep Phuoc) about 1,500 ha; – Hiep Phuoc Port 500 ha; – To the West (adjacent to Can Giuoc in Long An province) former wetland (water coconut) will be converted to infrastructure and residential area.
Remaining Share of Green & Open Spaces, Agriculture	– To partial effect, the land has been zoned to include open green and blue features in the draft land-use plan 2025 (1.3). – Estimated remaining share of open and green space= 10%.

Focus Area: **H**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.0 meters to <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– Currently all un-built up land is located within the floodplain of the Nha Be River and flooding caused by high-tide strongly affects the area.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will be confronted by frequent flooding caused by high-tide.
Planning Recommendations	– The required land for the required dyke system at Nha Be River is not visibly zoned in the LUP 2020. Here clear zoning is required to avoid improper urban development and costly re-location or re-settlement in the future. – The green riparian buffers along the banks of Nha Be River should be explicitly zoned and increased in width. – All new developments below the current max-tide level of 1.5 meters AMSL are at high-risk for tidal flooding. New developments in this area are only possible with an established clear holistic flood and water management concept for the whole area.
Stormwater	
Current Situation	– Only slight surface runoff is generated from this area (2.6).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1). – Avoid further soil sealing in the low-dense built-up areas to maintain the current low runoff conditions (3.2.1.).
Expected Changes	– Estimated remaining share of open and green space= 10%. – High surface runoff generation can be expected following realisation of LUP depending upon sealing degree. – Only in the park areas a semi-natural water balance can be obtained
Future Risk	– The risk of urban flooding due to urbanisation will increase sharply.
Planning Recommendations	– Increase the proportion of green areas (>50%).
Urban Climate	
Current Situation (3.3.1)	– Zone 2: Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone B:Southwest–northeast wind circulation zone. By keeping the porosity of the urban structure the ventilation conditions for the south of the city can be maintained.
Expected Changes and Future Risk	– Changes here will affect the urban heat island downtown, – Reduction of air movement. – The effects on urban climate will be felt onsite and offsite.
Planning Recommendations	– High climate sensitivity. – Land-use changes only allowed with openness of 50% coverage.

Focus Area: **H**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibit important functions for urban climate. Additionally, as low-lying land (below 1.5 m AMSL) on the floodplain of Nha Be River it is at a high risk from tidal-flooding. – The remaining green and open space are zoned within the LUP2020 as “Green Park Area” (code CVCX) centred in a north-south direction. This zoning in LUP2020 is supported by our assessment and should be enforced in the final Version of LUP2020. – The LUP2020 also zones currently un-built up land to new “Industrial Land” (SKK) and “Urban Residential Areas” (code ODT). This is in conflict with our assessment, as important air movements are reduced and blocked (Urban Climate), and surface-runoff will increase sharply (Storm Water Management) leading to both a high risk of flooding (Flood Risk). – It is recommended to reduce the zoning of new developments (ODT & SKK) and to increase the share (>50%) of open spaces (LUA, RDD and CVCX), as to maintain the ventilation corridors and to increase the area necessary for effective stormwater management. – The small green riparian buffers along the banks of the Nha Be River, zoned as “Green Area” (code CVCX), should be increased in width to avoid new developments on the riverbanks edge. – All new developments will require explicit flood protection measures. – The required land for the planned dyke system along the Nha Be River should be explicitly zoned within LUP2020.

Focus Area:	**1. General Description**
Location	
District	– Binh Chanh and Nha Be
Communes	– (Binh Chanh): Binh Chanh: An Phu Tay, Tan Quy Tay, Hung Long, Phong Phu, Da Phuoc, Tan Tuc. – (Nha Be): Phuoc Kien, Phuoc Loc, Nhon Duc, Phu Xuan, Long Thoi.
Land-use	
Current Situation	– Area of Binh Chanh is a residential area. There are some new resettlement areas in Phong Phu and area of HCMC's cemetery, waste-recycling site, and resettlement in Da Phuoc. Area of Nha Be is also residential area. There is one processing zone in the East of Long Thoi and one tourism area in the South of Phu Xuan.
Built-up Densities (on-site)	– The area is scarcely built-up and rural in nature (2.2) with low densities. – Buildings follow the main southbound highways such as QL50 and QL1. Population densities are generally very low (2.1), with the highest seen in Phuoc Loc and Phuoc Kien. – Aquaculture and agriculture land-uses dominate (1.1). – Building volumes (2.4) are moderate, highest along highway QL50 (2.4). – Floor spaces (2.3), coverage (2.3.2) and floor area ratios are low. – Overall soil sealing rates are low (2.5).
Built-up Densities (neighbouring areas)	– To the north built up densities increase dramatically in District 8 and to the east in District 7 and in Nha Be District.
Construction Activities	– Large proportions of this area are under construction activities (1.2).
Green & Open Spaces and Agriculture	– Approximately more than 80% of the area is currently non-built up and being used for agriculture purposes (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Area of Binh Chanh is residential area. There are some new resettlement areas in Phong Phu and area of HCMC's cemetery, waste-recycling site, and resettlement in Da Phuoc-Nha Be; universities, Phong Phu, Da Phuong, Quy Duc, etc. industrial zone.
Remaining Share of Green & Open Spaces, Agriculture	– Small green riparian buffers are the only green features and agriculture zoned in the land use plan 2025 (1.3). – Estimated remaining share of open and green space= 20%.

Focus Area:	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.5 meters to <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– Currently all non-built up land is frequently affected by flooding caused by high-tide.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will be confronted by frequent flooding caused by high-tide.
Planning Recommendations	– All new developments below the current max-tide level of 1.5 meters AMSL are at high-risk for tidal flooding. New developments in this area are only possible with an established clear and holistic flood and water management concept for the whole area. – The green buffers along all smaller rivers and canals (Dia-Doi, Phuoc long, Do, Phuoc kien, Muong chuoi, Tom, Onglon, Xom quang Rach, Caykho, Gonoi, Tacbenrom, Lao) that are important for drainage should be explicitly zoned and increased in width. – The protection of more green and open spaces (focus: below 0.5 meters AMSL) are required for water retention.
Stormwater	
Current Situation	– Only moderate surface runoff is generated from this area (2.6).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1). – Avoid further soil sealing in the low-dense built-up areas to maintain the current low runoff conditions (3.2.1).
Expected Changes	– Estimated remaining share of open and green-space= 20%. – The area is drained and incised by large number of canals and natural small rivers, which face alteration and modification from the planned development activities (2.2). – High surface runoff will be generated following the realisation of LUP depending upon sealing degree.
Future Risk	– The risk of urban flooding due to urbanisation will increase sharply.
Planning Recommendations	– Increase the proportion of green areas (>50%).
Urban Climate	
Current Situation (3.3.1)	– Zone 2: Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone B: (Dominate) Southwest–northeast wind circulation zone. By keeping the porosity of the urban structure the ventilation conditions for the south of the city can be maintained. – Zone V: (Western edge along Chodem River and Highway No. 1A) Ventilation zone. Monsoon winds in northeast and southwest direction.
Expected Changes and Future Risk	– Changes here will even affect the urban heat island downtown. – Reduction of air movement especially during low wind situations.
Planning Recommendations	– Land-use changes have to maintain fresh air production areas and the advections towards city centre. – Open areas should be protected (Zone 2). – New developments require site-specific urban climate assessments.

Focus Area:	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The focus area exhibits very important functions for urban climate regulation and for stormwater management for adjacent settlement areas (including high-dense developments in District 7) and is, as low-lying area (mainly below 1 meters AMSL) interconnected with the floodplain of Nha Be River, at high-risk of tidal flooding. – The LUP2020 rezones most of the existing un-built up (agricultural) land to mainly “Residential Land” (code ODT&ONT) and partly to “Industrial -” and “Infrastructure Development Land” (code SKK & DGT). – This zoning is in conflict with our assessment and should be prevented in order to avoid new developments occurring in high-risk areas located within the floodplain or influenced by the tide of Nha Be River. – Additionally these open areas have important functions for water management and urban climate regulation for the adjacent high-dense settlement areas of District 7. – The zoning of un-built up land as “Green Park Areas” (code CVCX) and “Agricultural Land” (code LUA) in LUP2020 is supported by our assessments, and should be enforced and extended to include additional lands. – For urban climate (maintenance of the important ventilation pathway) and for stormwater management, interconnected and explicitly zoned “Green Areas” (CVCX) and “Agricultural Land” (code LUA) with an overall share accounting to at least 50% would be recommended. – The green riparian buffers along the banks of the Nha Be River and the connected smaller rivers and canals in Binh Chanh & Nha Be District and, zoned as “Green Areas” (code CVCX) and “Agricultural Land” (code LUA) - should be enforced in the final version of the LUP2020 and generally increased in width to avoid new developments directly on the riverbanks edge and as to maintain the important wind ventilation pathways. – New developments are only possible with an established clear and holistic flood & water management concept for the whole area.

Focus Area: **J**	**1. General Description**
Location	
District	– Binh Chanh
Communes	– Le Minh Xuan, Tan Nhut
Land-use	
Current Situation	– Le Minh Xuan and Tan Nhut are residential areas. One part in Le Minh Xuan Ward is the Le Minh Xuan industrial zone.
Built-up Densities (on-site)	– The area is very scarcely built-up and rural in nature (2.2) with low densities. Aquaculture, agricultural, and forestry land-uses dominate (1.1). – Buildings follow the main highways such as Highway QL10 and are also clustered in Binh Chanh Industral Park. Population densities are generally very low (2.1). Building volumes (2.4), are low. – Floor spaces (2.3), coverage (2.3.2), and floor area (2.3.1) ratios are extremely low.
Built-up Densities (neighbouring areas)	– The area is adjacent to the denser Binh Tan District and somewhat denser Hoc Mon District.
Construction Activities	– Only a single construction site is visible (1.2).
Green & Open Spaces and Agriculture	– Aquaculture, agricultural and forestry land-uses dominate (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– Residential areas; One part in the Le Minh Xuan Ward is the Le Minh Xuan industrial zone. – The West will be new residential areas in which there are still 350ha rice field and more than 1,000ha of annual crop land.
Remaining Share of Green & Open Spaces, Agriculture	– A share of the land remains for aquaculture, agricultural and forestry use (1.3). – Estimated remaining share of open and green space= 40%.

Focus Area: **J**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– All un-built land has mainly an elevation below 0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– The area is frequently affected by flooding caused by high-tide.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will be confronted by frequent flooding caused by high-tide.
Planning Recommendations	– All new developments below the current max-tide level of 1.5 meters AMSL are at high-risk for tidal flooding. – New developments in this area are only possible with an established clear and holistic flood and water management concept. – The remaining agricultural land (zoned in LUP2020) has an important function for water-management issues. – The protection of more green and open spaces (focus: below 0.5 meters AMSL) would improve the capacity for water-retention.
Stormwater	
Current Situation	– Nearly no surface runoff is generated from this area (2.6).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 40%. – Medium to high surface runoff will be generated.
Future Risk	– The risk of urban flooding due to urbanisation will increase.
Planning Recommendations	– Increase the proportion of green areas (>50%).
Urban Climate	
Current Situation (3.3.1)	– Zone 2: (Dominant) Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas. – Zone 1: (Partial areas bordering Binh Tan District) Open areas with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas.
Current Ventilation Characteristics (3.3.1)	– Zone A: (Dominant) Well-ventilated zone by southeasterly winds. Good ventilation and cooling effects for adjacent settlements, decreasing towards the denser inner city districts. – Zone V: (Southern part along Highway no. 1A, boundary to Focus Area I). Ventilation zone. Monsoon winds in northeast and southwest direction.
Expected Changes and Future Risk	– Planned development is focused in former-agricultural lands of highest-climate importance (Zone 1). – South-westerly winds are reduced and will lead to increased urban heat loads downtown. – By maintaining a high share of agricultural land, overall adverse effects would be minimised.
Climate Recommendations	– From a climate point of view, existing agricultural land should be protected from development so southerly winds should not be blocked. – Any new development requires site-specific climate assessment, to ensure the protection of the important southerly ventilation paths.

Focus Area: **J**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area has important functions for stormwater management and urban climate, in particular for the adjacent settlement areas. As low-lying land (below 1.5 metres AMSL) it faces high risk of inundation. – The LUP2020 zones the current un-built up areas mainly as “Agricultural Land” (code LUA), “Specialised Forest Areas” (code RDD), and “Green Area” (code CVCX). – The zoning in LUP2020 is supported by our assessment and as such should be enforced in the final Version of LUP2020. – The LUP2020 also zones currently un-built up land to new “Urban or Rural Residential Areas” (codes ODT & ONT) and “Industrial- or “Infrastructure Development Land” (codes SKK & DHT). This is in strong conflict with our assessment, as important south-westerly winds would be reduced and even blocked (Urban Climate), and surface-runoff would increase (Storm Water Management) and developments would be at high risk of (tidal-) flooding (Flood Risk). – It is recommended to reduce the zoning of new developments (ODT, ONT, SKK and DHT) and to increase the share (>50%) of open spaces (LUA, RDD and CVCX), to open ventilation corridors in south- westerly direction and to reserve a sufficient area for stormwater management. – All new developments will require explicit flood protection measures.

Focus Area: **K**	**1. General Description**
Location	
District	– Hoc Mon and Binh Chanh
Communes	– (Hoc Mon): Xuan Thoi Son, Xuan Thoi Thuong, Tan Thoi Nhi. – (Binh Chanh): Vinh Loc A, Vinh Loc B, Pham Van Hai, Le Minh Xuan, Binh Loi
Land-use	
Current Situation	– To the East one tourism area (An Ha) and one orchard residential area (Tan Thoi Nhi). Residential areas.
Built-up Densities (on-site)	– The area is scarcely built up and rural in nature (2.2) with very low densities. – Aquaculture, agricultural, and forestry land-uses dominate (1.1). – Where buildings are present; they mainly follow the main highway Thanh Niên. – Population densities are very low (2.1). Building volumes (2.4) are extremely low. – Floor spaces (2.3), coverage (2.3.2) and floor area (2.3.1) ratios are extremely low.
Built-up Densities (neighbouring areas)	– The area touches on higher densities area of Binh Tan and Hoc Mon to the east.
Construction Activities	– No visible construction activities (1.2).
Green & Open Spaces and Agriculture	– The vast majority of the area is non-built up and currently being used for aquaculture, agricultural and forestry (1.1).
Land-use Plan 2020	
Planned Changes (provided by DONRE)	– This area has about 1,500 ha of protection forest land in Binh Chanh – A annual crop land in Vinh Loc A and Vinh Loc B Ward; – Fruit plantation and residential (Tan Thoi Nhi); – Residential and some areas will be converted into urbanised area.
Remaining Share of Green & Open Spaces, Agriculture	– A large proportion of the land has been zoned to include open green and blue features in the draft land-use plan 2025 (1.3). – Estimated remaining share of open and green space= 70%.

Focus Area: **K**	**2. Assessment of Land-use Plan 2020**
Flood Risk	
Current Situation (2.2, 2.7, 3.1.1)	– Average elevations range from 1.5 meters to <0.5 meters AMSL. – The area contains no un-built land above 1.5 meters AMSL.
Current Risk (2.7, 3.1.1)	– This area is frequently affected by stormwater accumulation from adjacent higher-elevated built-up land.
Future Risk (1.3.new, 2.2, 3.1.1)	– All new developments will take place in areas currently below 1.5 meters AMSL. – In the northern part of the area new developments are located in areas that are partly below the 0.5 meters AMSL and affected by accumulation of stormwater runoff from higher-elevated settlement areas of Hoc Mon District.
Planning Recommendations	– Zoning of new developments in areas with lowest elevation (below 0.5 meters) should be avoided. – The remaining agricultural land (zoned in LUP2020) has an important function for water-management issues.
Stormwater	
Current Situation	– Almost no surface runoff is generated from this area (2.6). – Surface runoff accumulation site for adjacent higher-elevated built-up areas (Hoc Mon District).
Protection Needs	– Protect the near-natural water balance of un-built up land (3.2.1).
Expected Changes	– Estimated remaining share of open and green space= 70%. – Status of surface – runoff will not change seriously.
Future Risk	– The risk of urban flooding due to urbanisation will not increase.
Planning Recommendations	– No change of uses in LUP required. – No further recommendations for LUP required.
Urban Climate	
Current Situation (3.3.1)	– Zone 1: (South and North of the Focus area. around Le Minh Xuan and Xuan Thoi Son) Open areas with significant climatic activity, cool and fresh air production; climatically active open sites in direct relation to settlement areas. – Zone 2: (Centre of Focus area, around Pham Van Hai) Open areas with less significant climatic activity; cool and fresh air production with effects for adjacent settlement areas.
Current Ventilation Characteristics (3.3.1)	– Well-ventilated zone by southeasterly winds. Good ventilation and cooling effects for adjacent settlements, decreasing towards the denser inner city districts.
Expected Changes and Future Risk	– Planned development is focused in former-agricultural lands of highest-climate importance (zone 1).
Planning Recommendations	– From a climate perspective, this area has an important function for cool air production. – Land use changes should respect orientation of buildings and openness of at least 25% coverage.

Focus Area: **K**	**3. Summary of Assessment Results**
Integrated Planning Recommendations	
Summary	– The area exhibits important functions for stormwater management and urban climate regulation, in particular for the adjacent settlement areas. As low-lying (mainly below 1.5 m AMSL), the area it is faced by a high risk of inundation. – The LUP2020 zones the remaining un-built up areas mainly to "Specialised Forest Areas" (code RDD), "Agricultural Land" (code LUA), and "Green Area" (code CVCX). This zoning within LUP2020 is supported by our assessment and as such should be enforced in the final Version of LUP2020. – The LUP2020 is zoning also currently un-built up land to new "Residential Areas" (code ODT & ONT) and "Industrial Land" (SKK). – In particular, planned developments in the north of the focus area are in conflict with our assessment results. This low lying (below 1.0 metre AMSL) zone is important for fresh air production (Urban Climate), while new developments here will be confronted by a high risk of inundation (Flood Risk). We highly recommend against zoning new developments (ODT & SKK) in this zone. – All new developments will require explicit flood protection measures.

1. Introduction
Strategic Environmental Assessment of Land-use Planning in HCMC

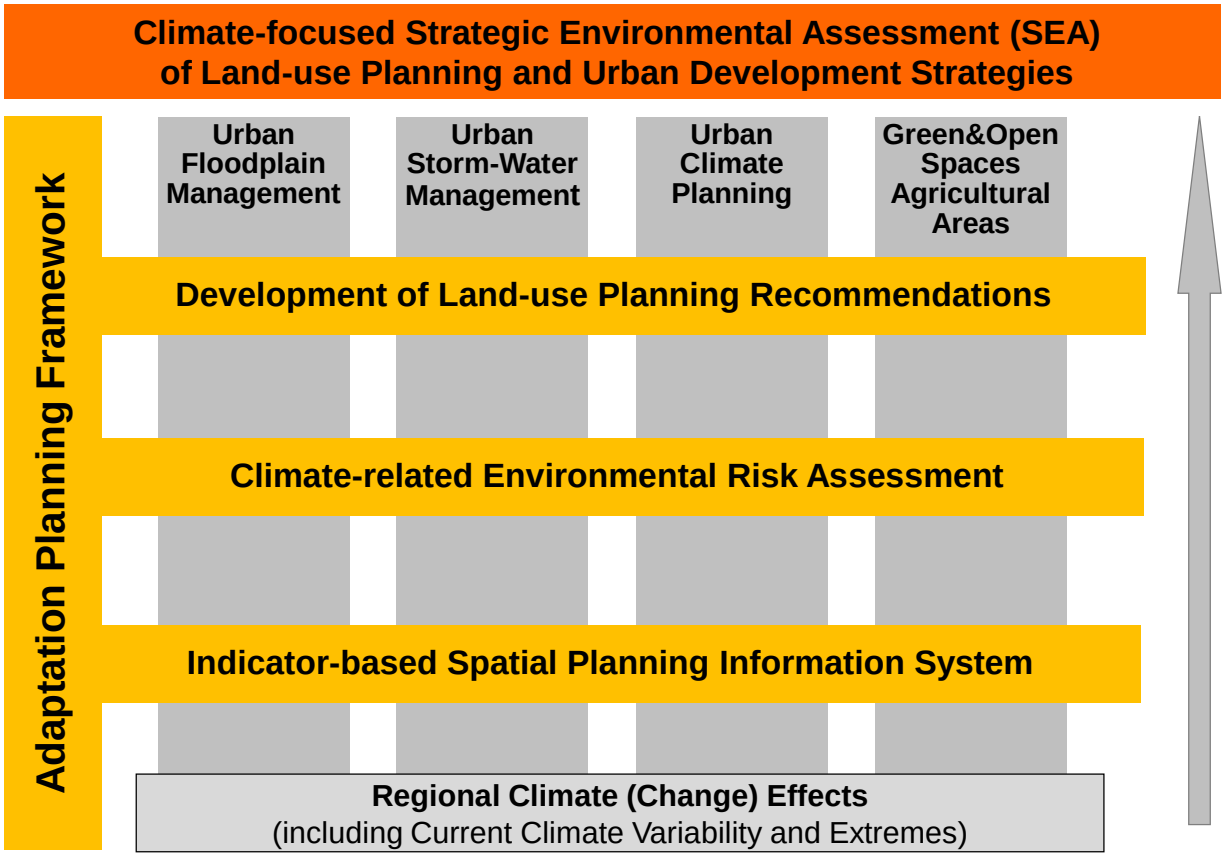


Figure 1:Strategic Environmental Assessment of Land-use Planning in HCMC

Chapter 1 gives a short overview of basic information and important spatial information related to Land-use Planning in HCMC:

Current Land-use in HCMC for the year 2010
Urban Development Direction - Construction Activities in 2009/2020
Draft Land-use Plan for the Planning Period up to 2025
Focus Areas for Land-use Changes and Planning Recommendations

1.1 Current Land-use in HCMC for the year 2010

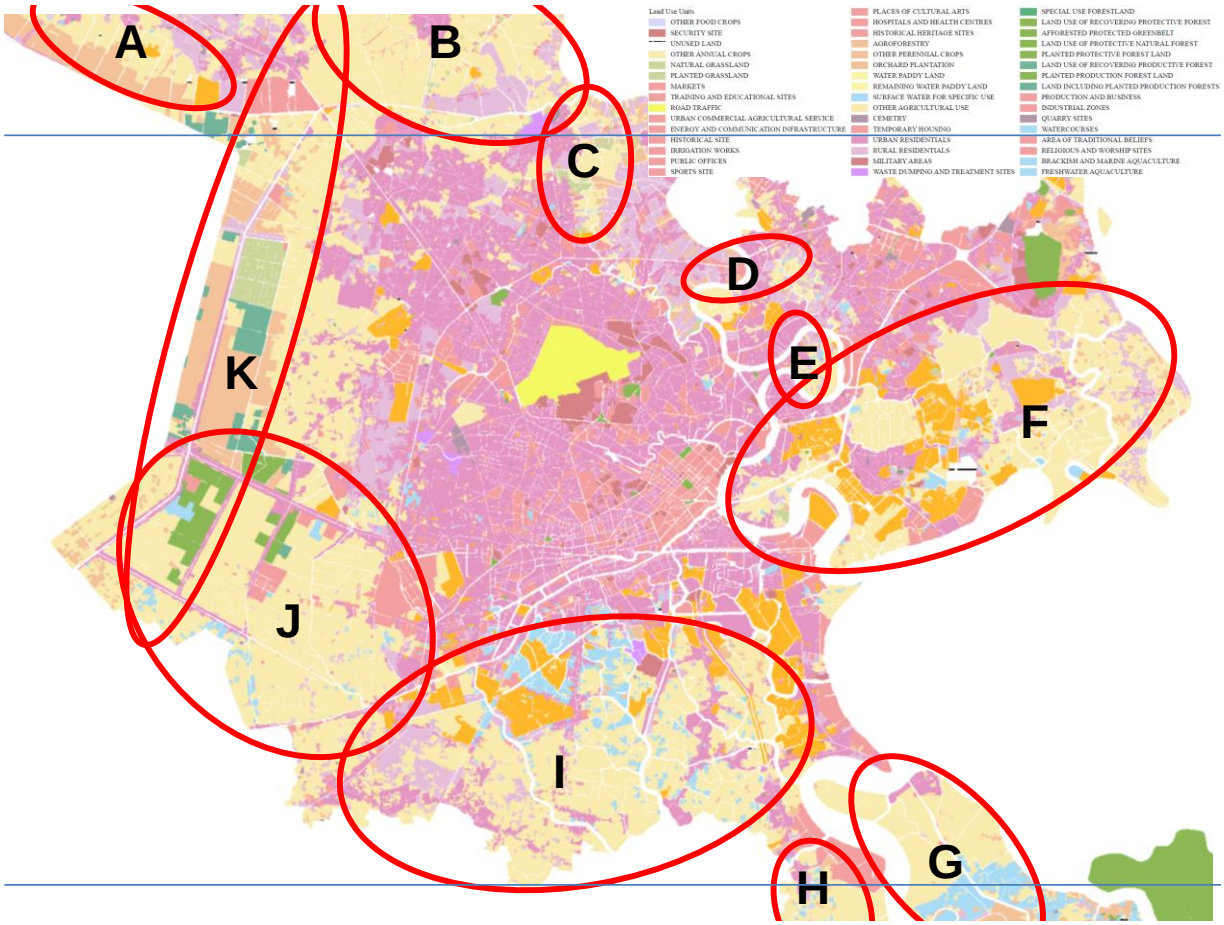


Figure 1.1: Current land-use of Ho Chi Minh City in the year 2010

Current land-use was determined from an urban structure type classification for the entire HCMC urban area. This involved the visual interpretation of high resolution panchromatic satellite imagery captured primarily in 2009 and 2010 and local site surveys (see LUPR ch. 4.1). Urban planning decisions require the rational characterisation of the current urban landscape according to relevant features for environmental assessment of land-use decisions. The urban structure type approach (see LUPR ch. 4.1) allows for the initial and further differentiation of the urban landscape on the basis of each structure's biophysical and socio-economic characteristics. As such, the approach represents the urban system at a higher differentiation than commonly seen in official land-use maps. Moreover the approach attempts to spatially represent core indicators concerning environmental, social, and demographic aspects. For example, differing degrees of soil sealing exhibited by different structures are accounted for within the classification. This approach allows for the multi-disciplinary identification of core indicators for spatially explicit urban assessment, integrating procedures from various thematic and scientific disciplines. Another function of the approach is the definition of a commonly accepted framework to structure urban regions into comparable types of spatial areas using the official land-use map as a basis. This overcomes difficulties in data compatibility, data scarcity, data availability, and data quality. In total, eighty-two discrete urban structure types were devised and assigned to the 16,292 blocks in the common spatial geometry of the official land-use map 2010.

1.2 Urban Development Direction - Construction Activities in 2009/2020

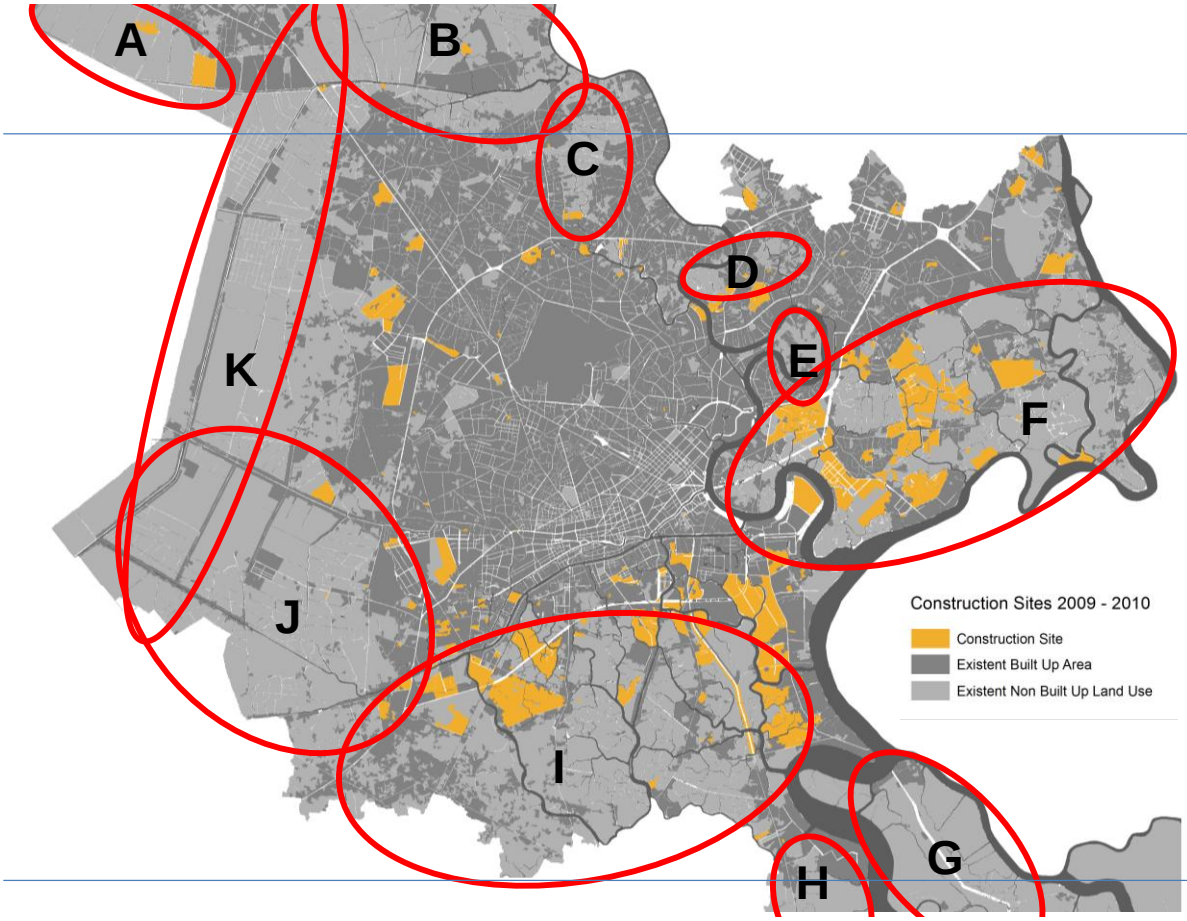


Figure 1.2: Urban Development Direction –Major Construction Sites detected during 2009-2010

During the mapping process for the current land-use mapfor the year 2010 (see LUPR ch. 5.4), a total area of around 55 km^2 with visible construction activities could be identified (Figure 1.2). As the currentland-use map was determined on the basis of the visual interpretation of high resolution satellite imagery captured in the time period 2009-2010, many of the marked construction sites, which are located in the urban fringe, may have already been subsequently developed.

The focal point and the dynamic building activities of current real estate projects in districts 2 (Thu Thiem), 7 (Phu My Hung) and 9 (below Thu Duc) in the south and east of the city; which currently form the frontier of urban development, can be verified. In addition it is visible that the majority of the new construction sites are in accordance with zoning for future development areas of the land-use plan up to 2010 and the draft-version of the land-use plan for 2025 (see Chapter 1.3).

1.3 Draft Land-use Plan for the Planning Period up to 2020

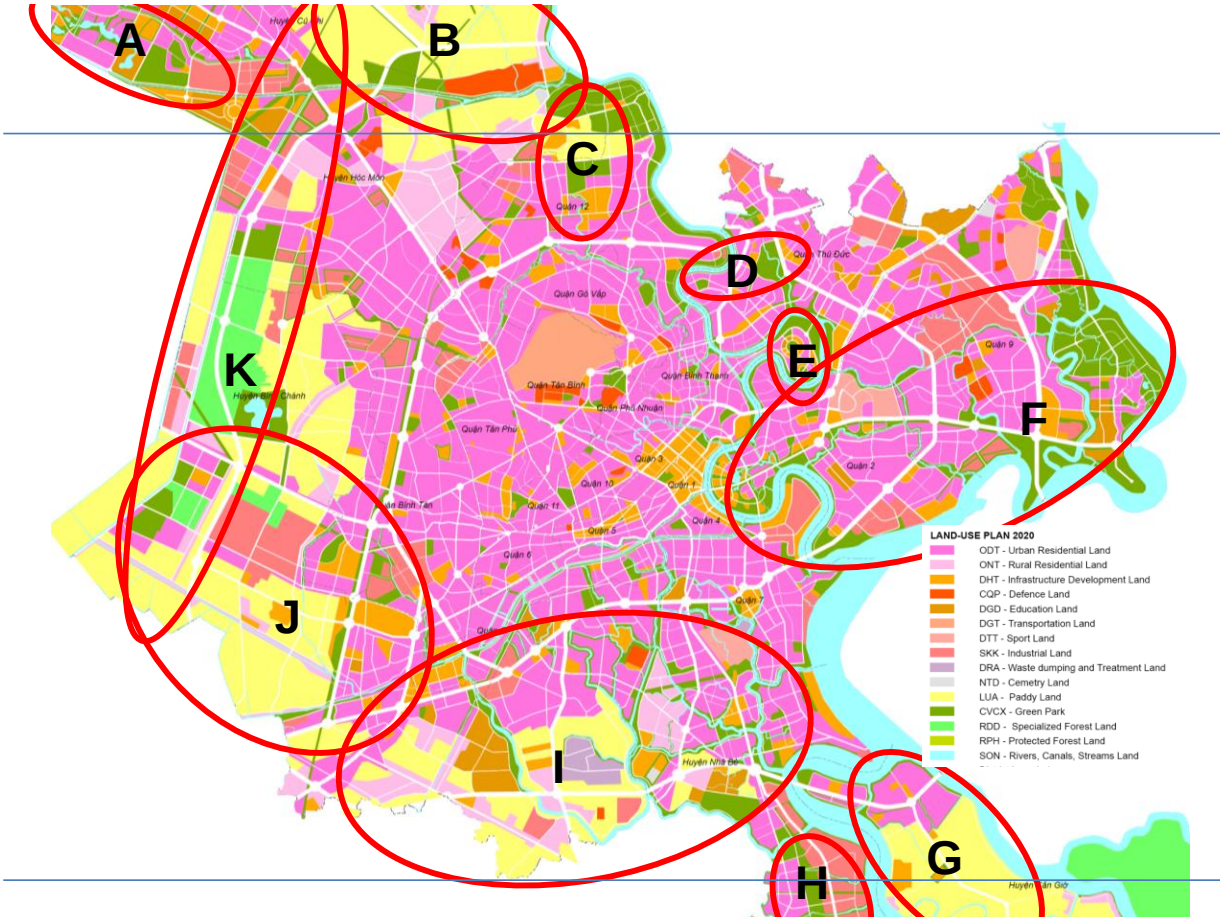


Figure 1.3: Current land-use and official land-use plans for 2010 and up to 2020

In March 2008 the People's Committee of HCMC approved a revised master plan designed to guide the urban development up to 2025. The most important agencies which determine overall land use, spatial zoning, and environmental quality in HCMC are the Department of Natural Resources and Environment (DONRE), the Department of Architecture and Planning (DPA), and the Department of Construction (DOC).

While DPA and DOC formulate the master plan (urban development plan), DONRE is responsible for drafting and updating of the land-use plan, which is developed from the master plan. The next update of the land-use plan will describe the medium-term development of the city until 2020. DONRE's land-use plan and DPA's and DOC's new master plan are the most influential spatial plans that will shape the nature of HCMC's urban development for the next decades (see LUPR ch. 5.3).

1.4 Focus Areas for Land-use Changes and Planning Recommendations

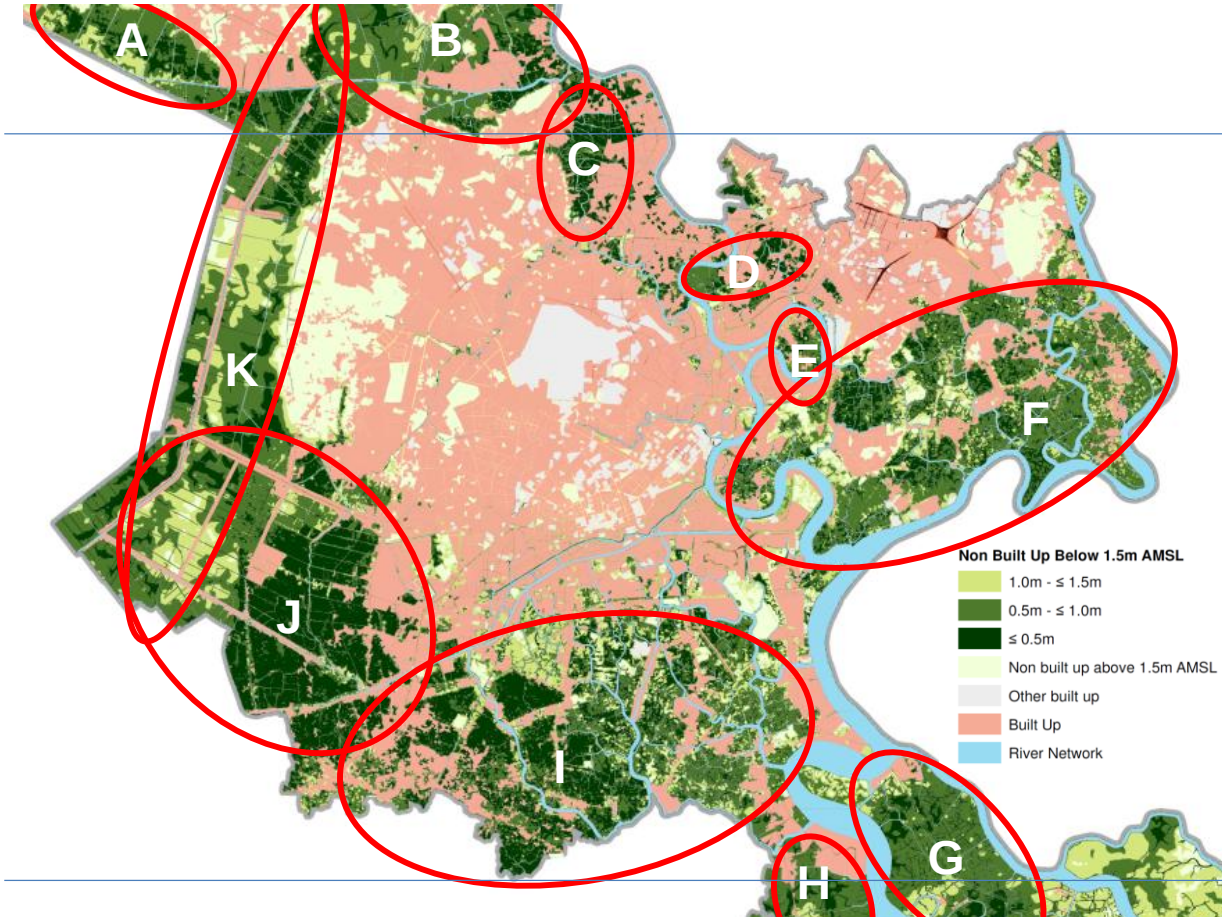


Figure 1.4: Focus Areas for Land-use Changes and Planning Recommendations

(Summary of key changes compiled by the DONRE-consultants overleaf)

Summary of Proposed Land Use Changes in the Focus Areas (provided by DONRE-Consults)

Area	*District*	*Location*	*Planned Land-use Changes*
A	*Cu Chi*	*Tan An Hoi, Tan Thong Hoi, and Tan Phu Trung*	*Urbanized area in the North West, solid-waste management, industrial land, universities, chemistry-pharmaceutical industry.* *This area will change almost 100% from agricultural to non-agricultural land.*
B	*Cu Chi*	*Hoa Phu, Tan Thanh Dong, and Binh My*	*Plan to be river-eco-tourism area, 1,500ha rice plantation area (Binh My & Tan Thanh Dong); eco-tourism area (Tan Thanh Dong);* *national security area to the South of Belt Road 3.This area (B) will change less than the Area A.*
C	*Hoc Mon*	*Dong Thanh*	*Along the river will be green area; the remaining of Dong Thanh commune will be converted to non-agricultural land; existing landfill will be treated and developed to green park, the pollution in this area will be improved.*
D	*Thu Duc*	*Hiep Binh Phuoc*	*Most of the area in Hiep Binh Phuoc will be developed to residential area (low density); build up dyke system to prevent flooding for SaiGon River banks.*
E	*Binh Thanh*	*Binh Quoi*	*Will build up dyke system around Thanh Da peninsula;* *Binh Quoi eco-tourism area with higher green coverage.*
F	*2 (West) & 9 (East)*	*An Phu, An Loi Dong, Thanh My Loi, Cat Lai Long Thanh My, Truong Thanh, PhuHuu, Long Truong, Long Phuoc*	*Former agricultural area of around 4,900ha in Dist 2&9, 1,000ha of cash crop will be kept, the rest will be converted to non-agricultural land:* *residential area (low density), universities (Dist.9), Belt Road 2 & 3 will pass through this area; dyke system for Dong Nai River.* *This will be urbanized area of technology-science, one in four satellite centers of HCMC.*
G	*Can Gio*	*Binh Khanh*	*This is the rural residential area, with aquaculture (shrimp, crabs, fishes, etc.). Not much change.*
H	*Nha Be District*	*Hiep Phuoc*	*Residential and industrial area (HiepPhuoc) about 1,500ha; HiepPhuoc Port 500ha; to the West (adjacent to Can Giuoc-Long An) former wetland (water coconut) will be converted to infrastructure and residential area.*
I	*Binh Chanh & Nha Be*	*Binh Chanh: An Phu Tay, Tan Quy Tay, Huyng Long, Binh Hung, Phong Phu, Da Phuoc. Nha Be: Phuoc Kien, Phuoc Loc, Nho nDuc, Phu Xuan*	*Area of BinhChanh is residential area. There are some new resettlement areas in PhongPhu and area of HCMC's cemetery, waste-recycling site, and resettlement in Da Phuoc-Nha Be; universities, PhongPhu, Da Phuong, QuyDuc, etc. industrial zone.*
J	*Binh Chanh*	*Le Minh Xuan, Tan Nhut*	*Residential areas; one part in the Le Minh Xuan Ward is the Le Minh Xuan industrial zone; the West will be new residential areas in which there are still 350ha rice field and more than 1,000ha of annual crop land.*
K	*Hoc Mon & Binh Chanh*	*XuanThoi Nhi, Xuan Thoi Son, Xuan Thoi Thuong, Binh Loi& Le Minh Xuan*	*This area has about 1,500ha of protection forest land in Binh Chanh; annual crop land in Vin hLoc A and Vinh Loc B Ward; fruit plantation and residential (Tan Thoi Nhi); residential and some areas will be converted into urbanized area. In general, this area has fewer changes, compared with others.*

2. Indicator-based Spatial Planning Information System

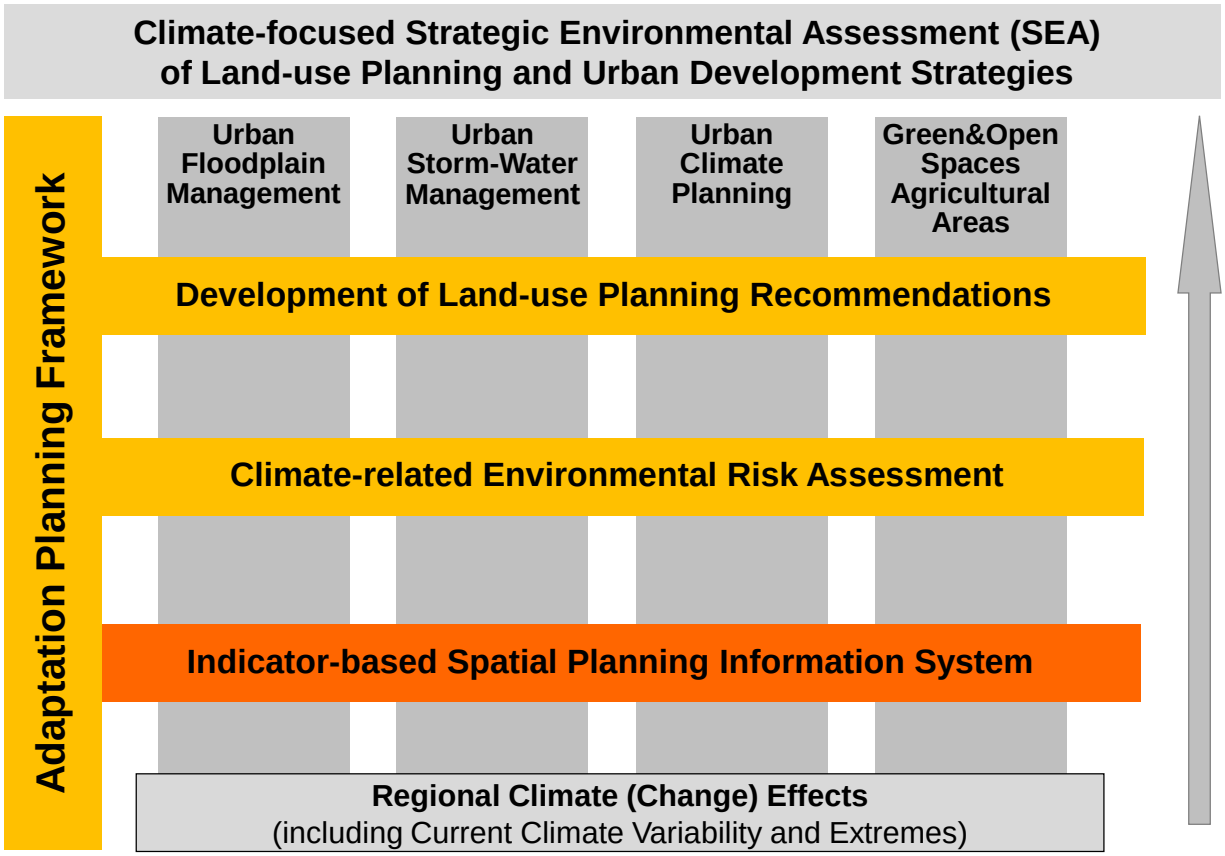


Figure 2: Indicator-based Spatial Information System

Following core indicators of the spatial information system are mentioned in this chapter:

Population Density and Distribution in 2010
Built-up Areas - Building Footprints in 2010
Built-up Areas – Built-up Ratio (Floor space per Block)
Built-up Areas - Building Volume in 2010
Built-up Density – Impervious Surfaces in 2010
Surfaces Run-off of Precipitation
Digital Elevation Model of Ho Chi Minh City

Additional indicators, urban development scenarios, and urban structural indicators are explained in more detail in LUPR (ch. 4 and 5).

2.1 Population Density and Distribution in 2010

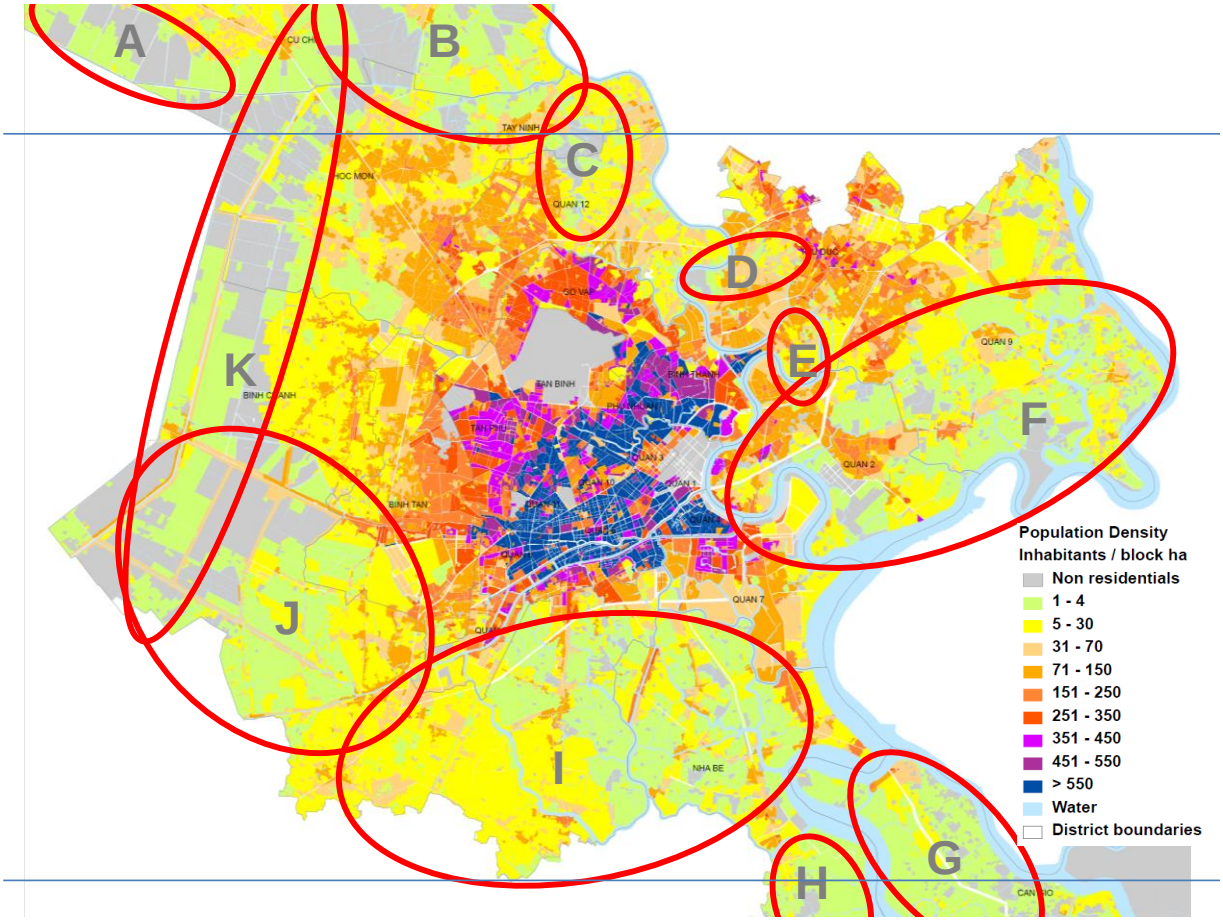


Figure 2.1: Population Density and Distribution of Ho Chi Minh City in 2010.

The total administrative area of HCMC is about 2095 km^2, divided into 24 districts, which hosted in 2010 an official population of 7.3 million. The districts division includes 12 “urban” districts (districts 1 through 12), 7 rapidly urbanising districts (Go Vap, Tan Binh, Tan Phu, Binh Thanh, Phu Nhuan,Thu Duc, Binh Tan) and 5 mainly rural “outer” districts (Cu Chi, Hoc Mon, Binh Chanh, Nha Be and Can Gio) (see LUPR ch. 5.2).

As of 2010, a population of 6.0 million resided in the 19 urban and rapidly urbanising districts, occupying an area of 494 km^2 with an average population density of around 12.267 pers/km^2, with the rest sum of 1.3 million divided between the rural districts at an average population density of 835 pers/km^2. Within the inner-city urban areas on an area of 140 km^{2}are concentrating more than half of the population resulting in an average density of23.200 pers/km^2. However, if the estimated, 2 million migrants and people residing on a non-residential and seasonal basis are included, the actual population of HCMC might be more than 9 million.

HCMC is currently undergoing rapid urbanisation to such an extent that by 2020 official estimates suggest population of more than 10 million. In 2009, the inner districts of HCMC experienced a significant stagnation or decrease in population, while at the same time the surrounding periphery districts showed a sharp spike in population with often experiencing a gain of more than 20 percent.

2.2 Built-up Areas - Building Footprints in 2010

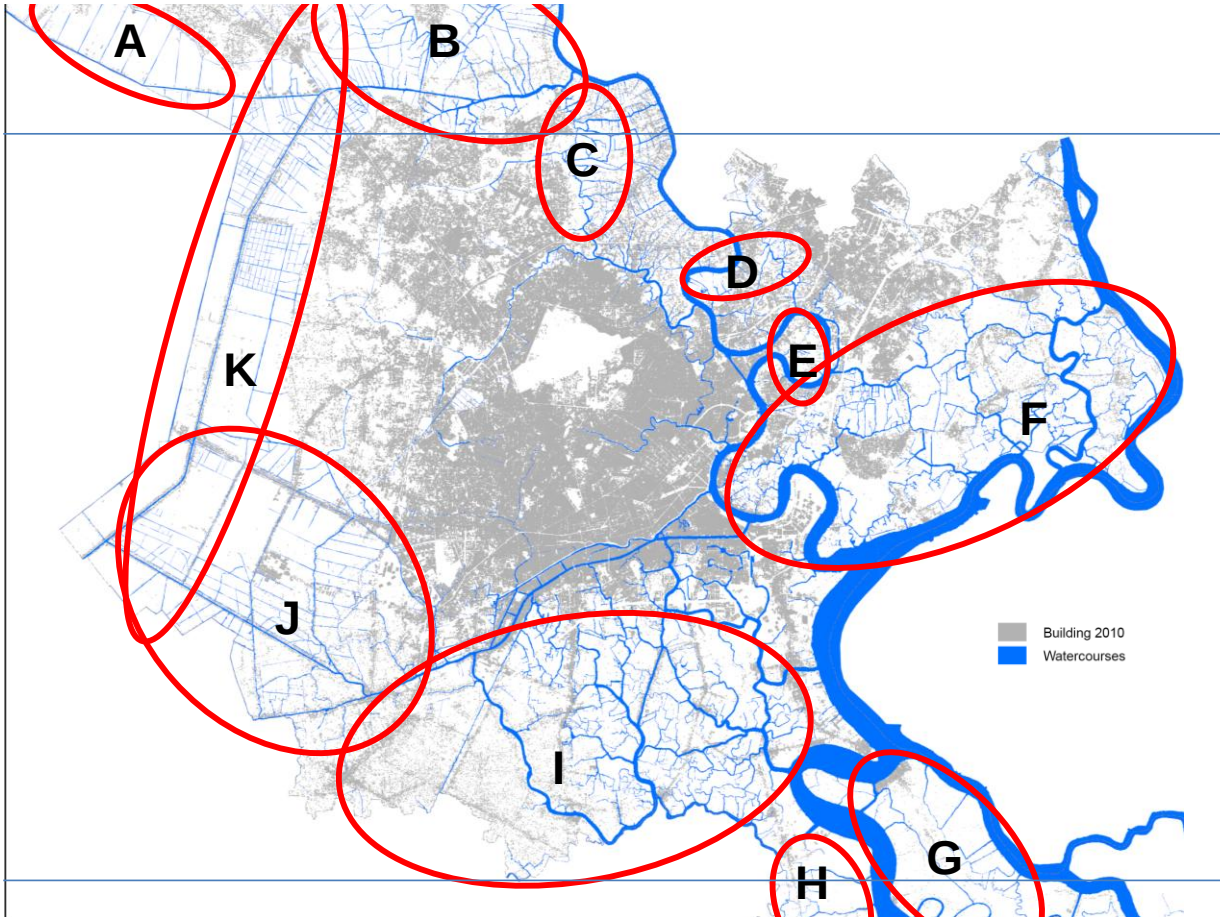


Figure 2.2: Built-up Areas - Building Footprints in 2010

While the inner core of HCMC is particular dense, recent growth however has been stronger in the outer core and urban fringe in lower dense developments (Figure 2.1 & 2.2).

Originally founded on relatively higher grounds, the city has densified through the infilling of open spaces or the redevelopment of existing buildings. However recently, great concern has been raised at the city's rapid expansion into the lower-lying and former wetland surroundings, primarily at the expense of urban greenscape and valuable multifunctional natural areas.

2.3 Built-up Areas – Built-up Ratio (Floorspace per Block)

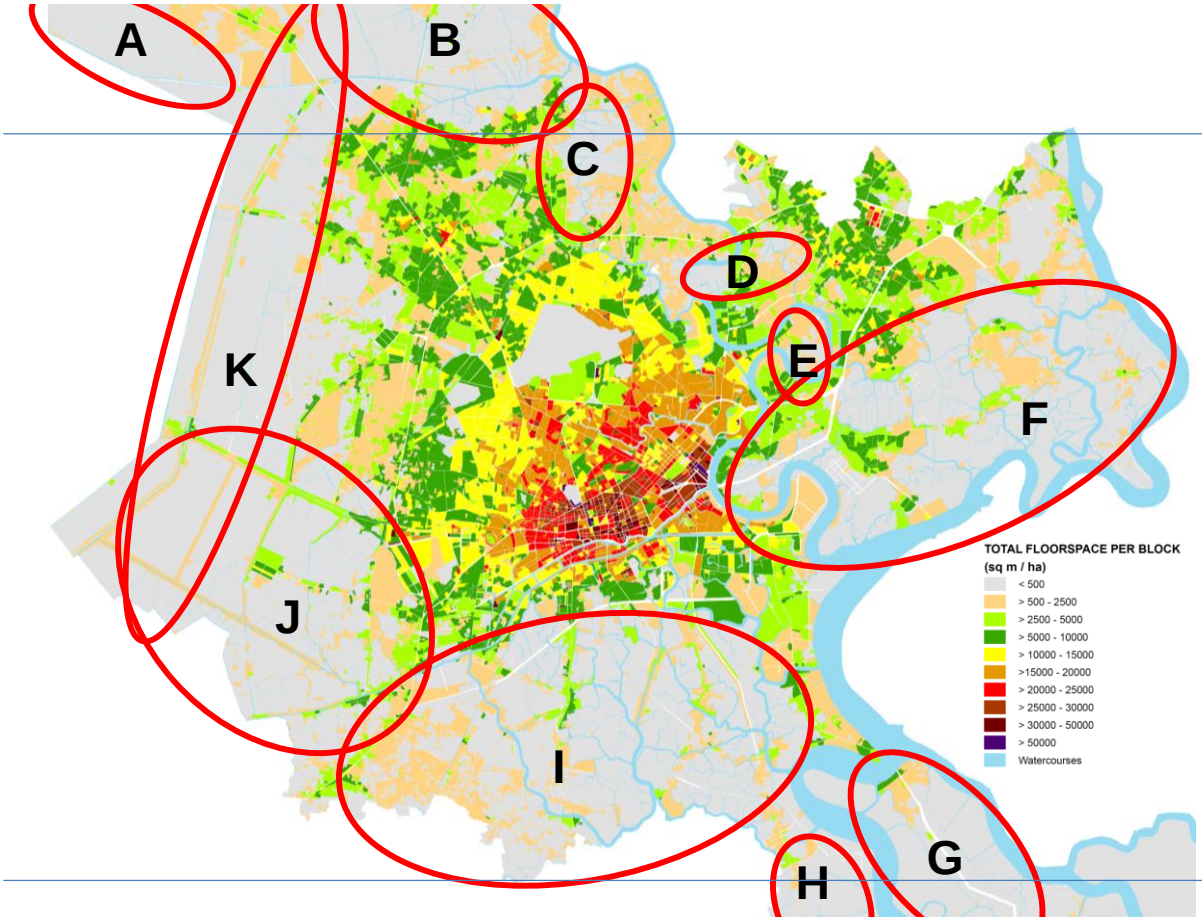


Figure 2.3: Built-up Areas – Built-up Ratio (Floorspace per Block)

In general, the ratio between built-up and un-built land provides an initial and overall impression of the spatial character of the city. Built-up areas typically include residential areas, industrial, and commercial areas.

The extremely high-dense development of the inner city, with floor area ratios of 1.5 and more (Figure 2.3), is mainly a manifestation of the necessity to adapt to the topographical situationof the city and its geography.

2.3.1 Ground Coverage-Ratio (GCR)

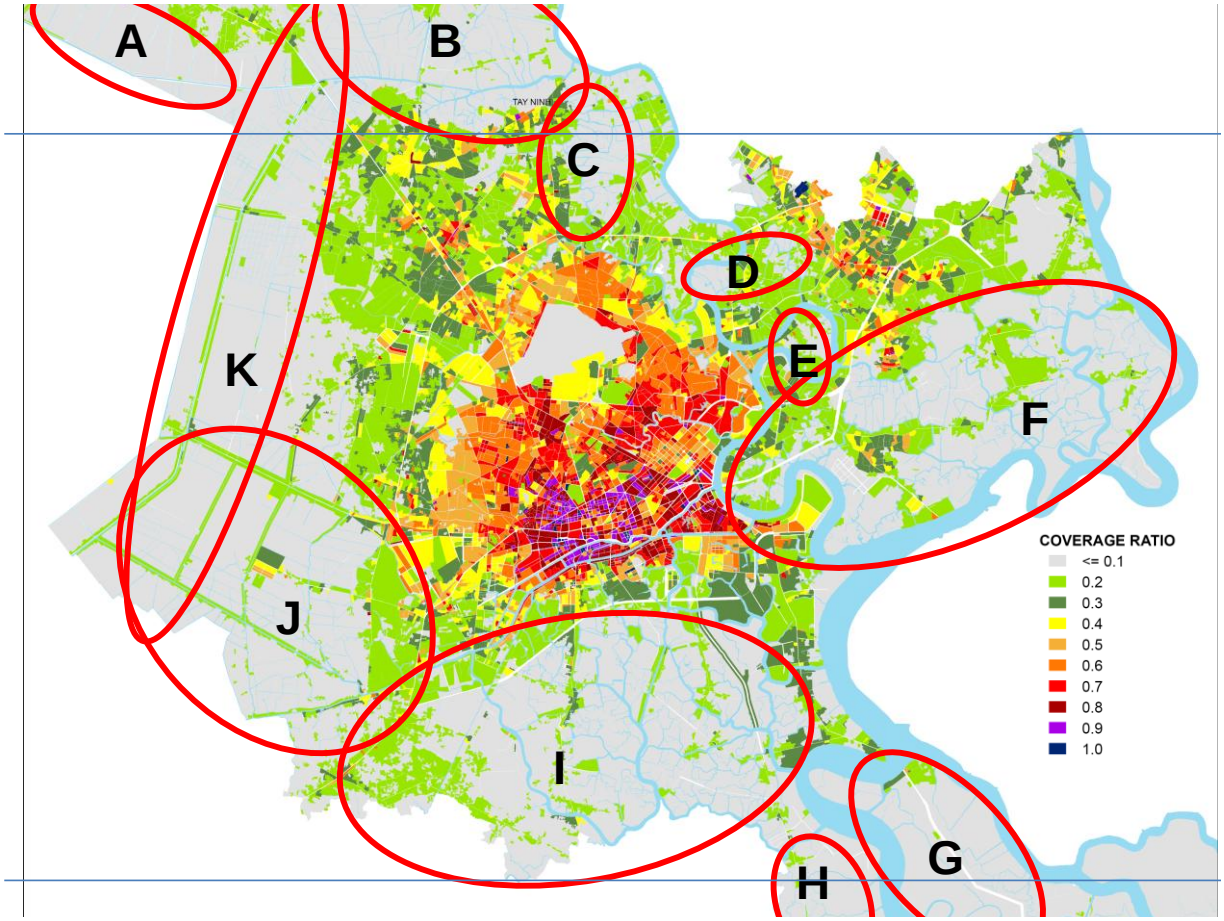


Figure 2.3.1: Ground-Coverage Ratio (GCR)

Ground coverage ratio is calculated by dividing the area of the ground floor of all the buildings footprints per land-use block by the area of the land-use block. It provides an indication of land-use intensity.

2.3.2 Floor-Area-Ratio (FAR)

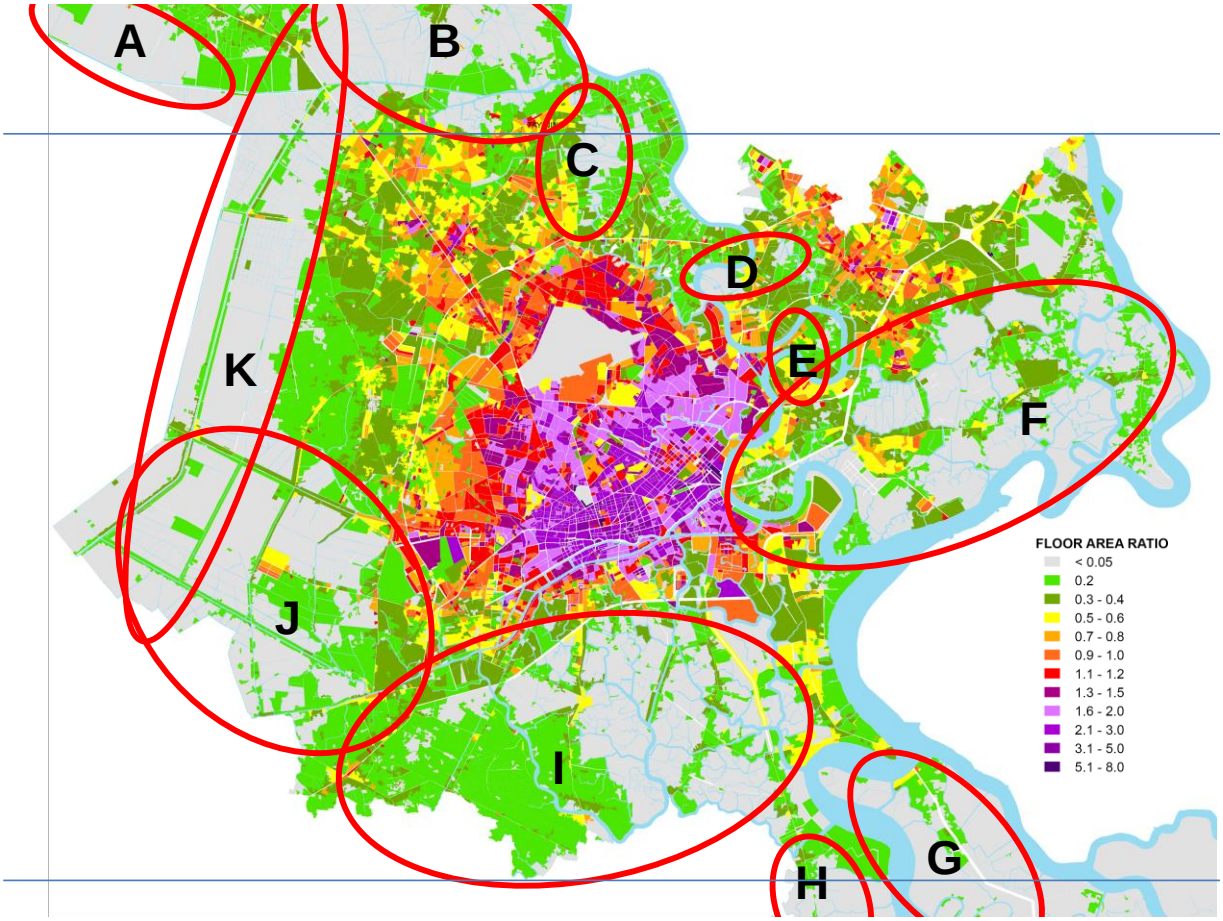


Figure 2.3.2: Floor Area Ratio (FAR)

FAR = the total covered area on all floors of all buildings within a land-use block divided by the area of the of the land-use block.

As such a FAR of 2.0 would indicate that the total floor space of the buildings within of a land-use block is twice the total area of the block upon which they are constructed.

2.4 Built-up Areas - Building Volume in 2010

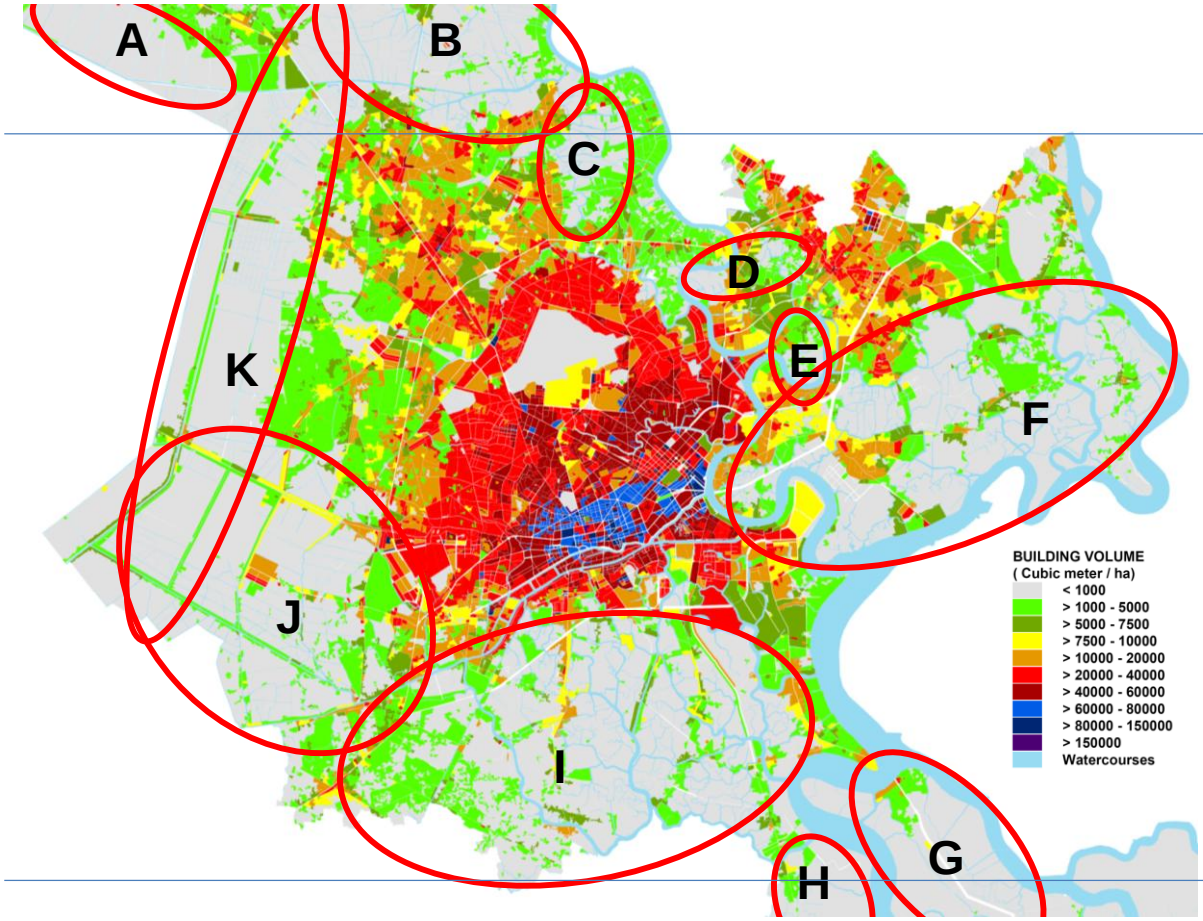


Figure 2.4: Built-up Areas - Building Volume in 2010

The extremely high-dense development of the inner city, with building volumes of between 20,000 and 150,000 cm^3 per hectare are one of the main influencing factors for the urban heat island effect and an important consideration for urban climate planning (see Chapter 3.3).

2.5 Built-up Density – Impervious Surfaces in 2010

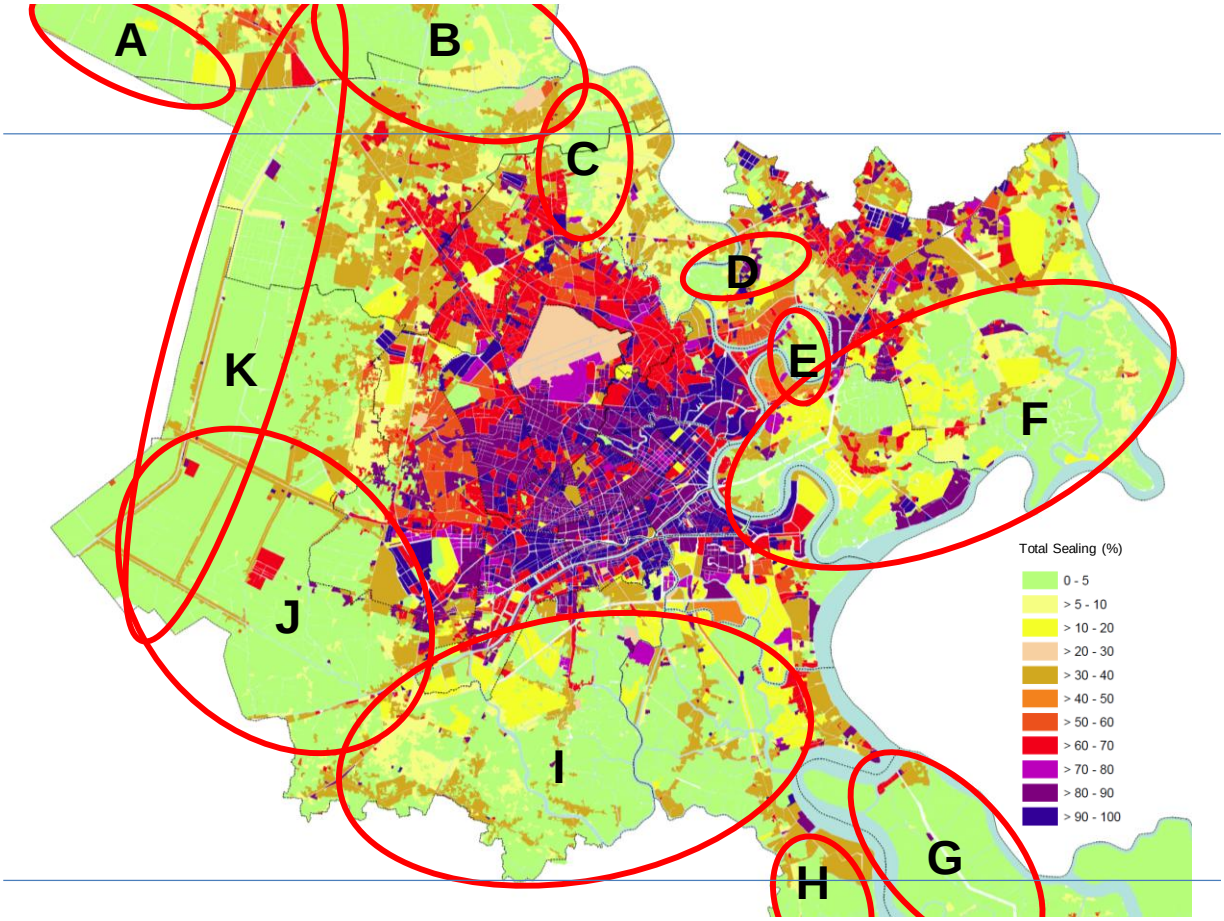


Figure 2.5: Degree of Imperviousness 2010 in HCMC

One of the key environmental indicators for urban agglomerations is impervious surface coverage (see LUPR ch.1.2.1). The level of imperviousness not only exerts a strong influence on the urban hydrology but also on urban climate. The amount of impervious surface coverage strongly affects the environmental quality of urban and surrounding areas. The extent of imperviousness correlates with both the urban heat island (UHI) affect and increased surface runoff. Mitigating for the affects of both UHI and increased surface runoff are two of the major environmental challenges currently being faced by HCMC.

2.6 Surfaces Run-off by Precipitation

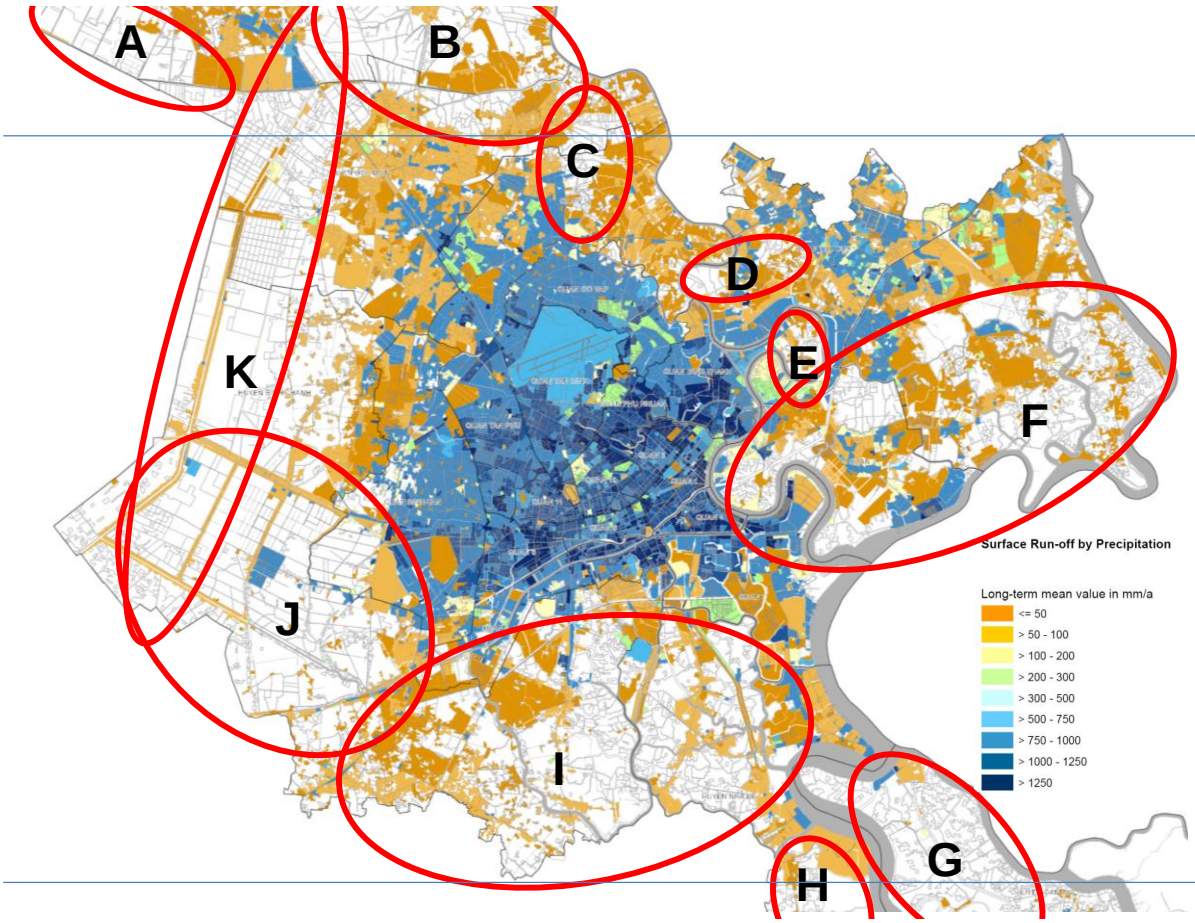


Figure 2.6: Modeled mean annual surface water run-off from precipitation for HCMC in 2010

Urban agglomerations like HCMC are sealed to different degrees according to the related urban densities and structures present (see chapter 2). Normally a large proportion of precipitation is quickly converted to surface runoff (see Figure 2.6). Often the existing drainage and sewer systems in the fast growing cities in tropical regions like HCMC do not have the capacity to cope with large surface runoff volumes following heavy rainfall events. Here combined, heavy rainfall and high tides inundated many low-lying parts of the city. Together with the superimposition of natural retention areas, the water balance is disturbed, so that a compelling need for dedicated site specific risk assessment and planning arises (see Chapter 3.2).

For the shown mapped area, from the total annual precipitation input of 1572 mm (which is the current mean value for the mapped area), 225 mm or approximately 14% is unable to infiltrate or evaporate and converts into surface run-off. This figure for surface runoff increases to values between 750 mm and more than 1000 mm per year for the highly built-up areas in the inner city core of HCMC (see LUPR ch. 1.1 & 1.3).

2.7 Digital Elevation Model of Ho Chi Minh City

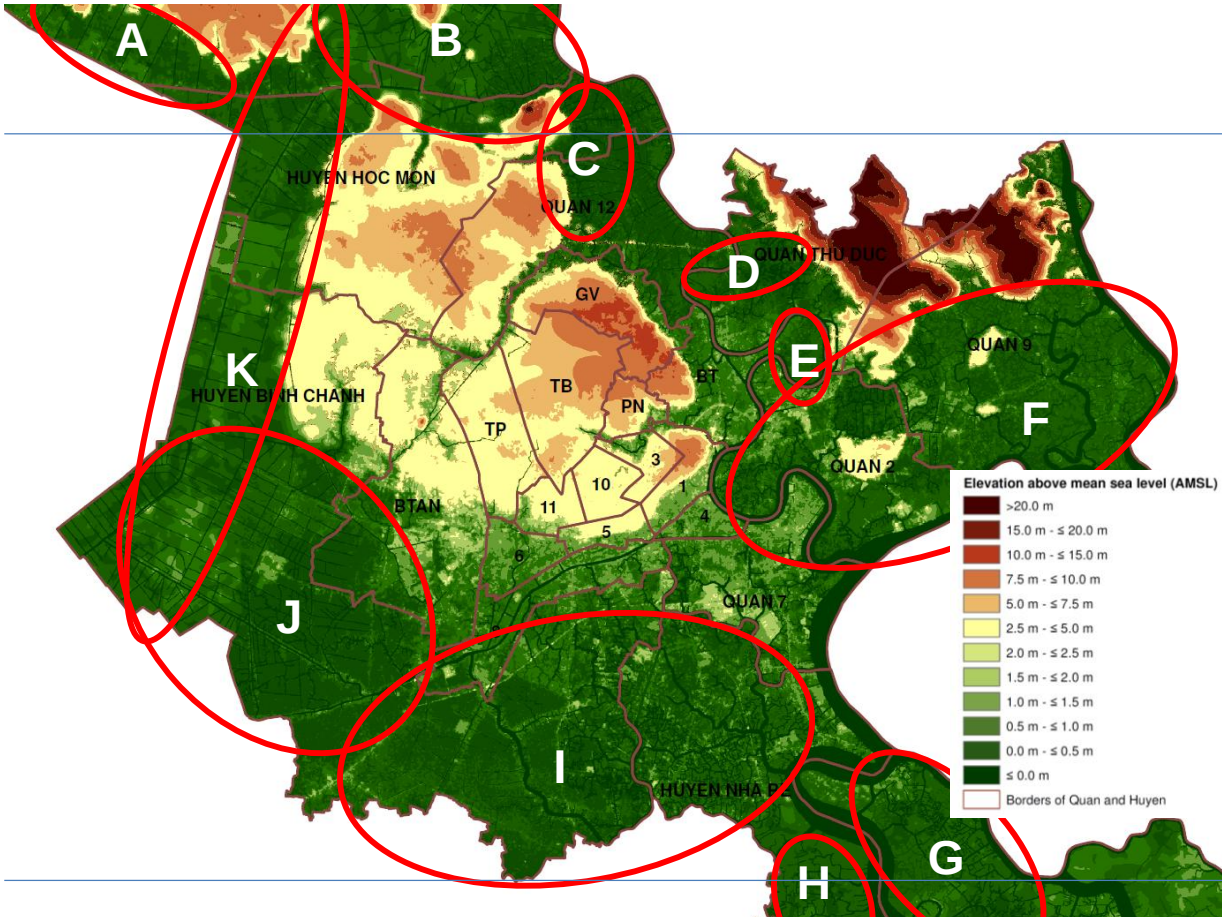


Figure 2.7: Digital Elevation Model of Ho Chi Minh City

Most of HCMC's area is distinctively low and flat. The terrain elevation varies from 4-32 m above mean sea level (AMSL) in the north-northeast to southern coastal lowlands at 0-1 m or below AMSL. It was calculated that 70% of the whole urban area of HCMC is below 2 m AMSL. Furthermore, 98.8% percent of the southern rural districts of Nha Be and Can Gio are below 2 m AMSL, while in contrast, for the two northern rural districts Cu Chi and Hoc Mon, the figure is 38.3% (Figure 2.7).

3. Development of Land-use Planning Recommendations

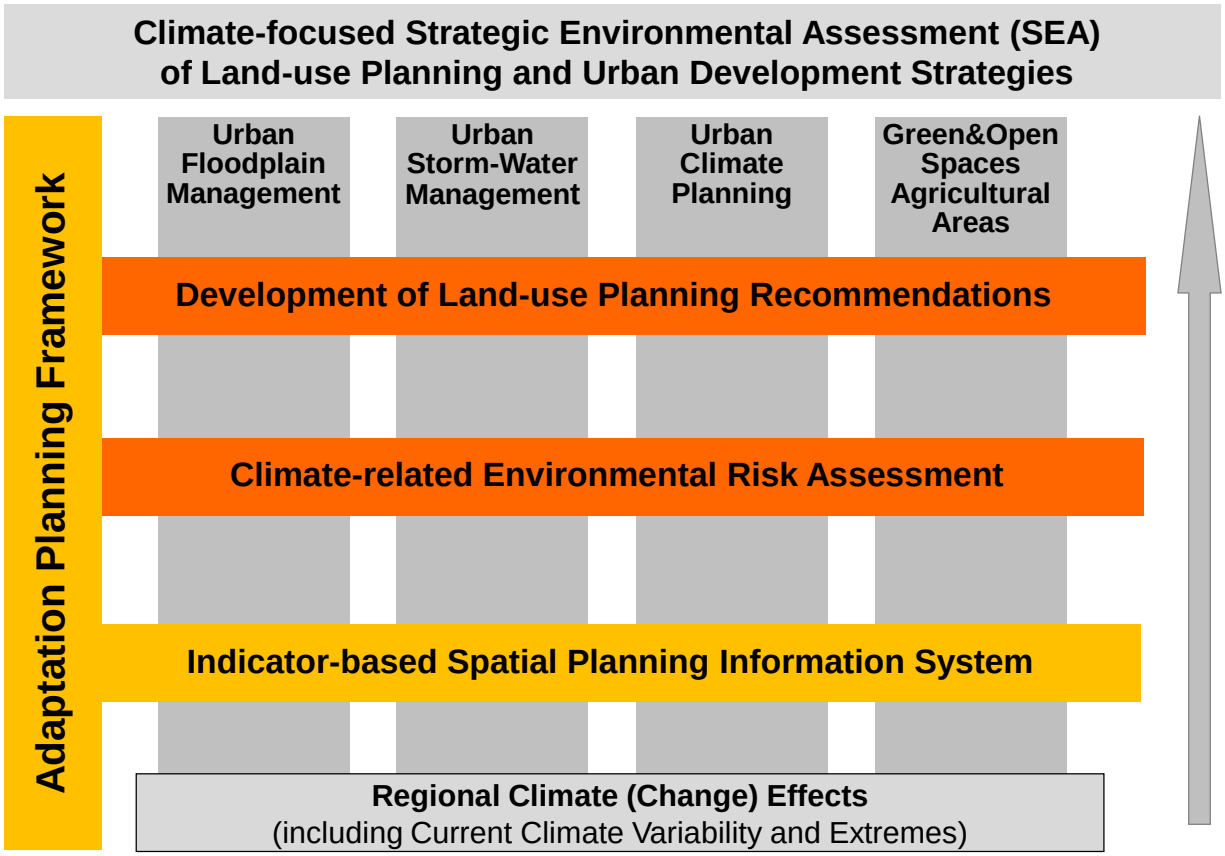


Figure 3: Development of Land-use Planning Recommendations

The development of land-use planning recommendations based on climate-related spatial environmental risk assessment is structured according following planning themes:

Urban Floodplain Management
Urban Storm Water Management
Urban Climate Planning
Green and Open Spaces – Agricultural Land

3.1 Planning Recommendations – Urban Floodplain Management

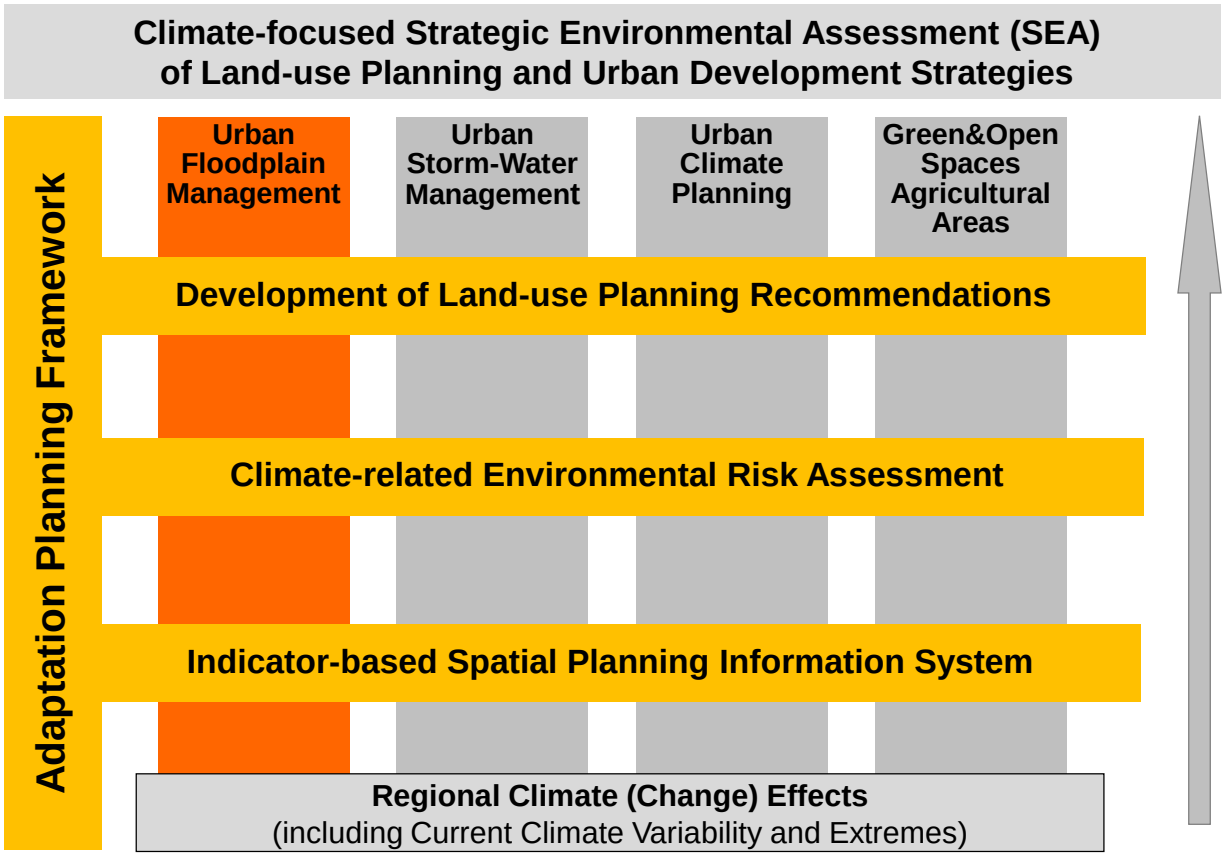


Figure 3.1: Land-use Planning Recommendations – Part Floodplain Management

The basic spatial information sources for an elevation-based flood-risk map – a detailed Digital Elevation Model and actual land-use maps - are available (see LUPR ch. 2.4). As shown in the map (Figure 3.1.1), most of the un-built up land in close proximity of the current dense built-up areas in the urban districts is mainly below an elevation of 1.5 m AMSL.

To demonstrate the amount of land exposed to inundation from various extreme flood levels, the assessment took the form of an elevation-based GIS analysis. The current max-tide level for HCMC is 1.5 m AMSL. Integrating the mapped built-up areas, the results show that a significant proportion of the current built-up area (2010) is already exposed to flooding (see Figure 3.1.1). Currently about one third of the total built-up land is exposed to potential inundation from a current max-tide water level of 1.5 m AMSL. This exposure is concentrated in a few hot-spots, with the highest exposure mostly seen in low-lying areas recently developed during the last 10 years (2000-2010).

Since 2000, the urban expansion of HCMC has taken place in the low-lying peripheral and suburban areas. These areas are already known to be prone to flooding in high-tide events. Natural streams, channels, lakes, wetlands and vegetation structures that can maintain the urban water balance have been replaced by impermeable surfaces causing increased surface run-off and increased the risk of urban flooding.

3.1.1 Planning Recommendations – Urban Floodplain Management

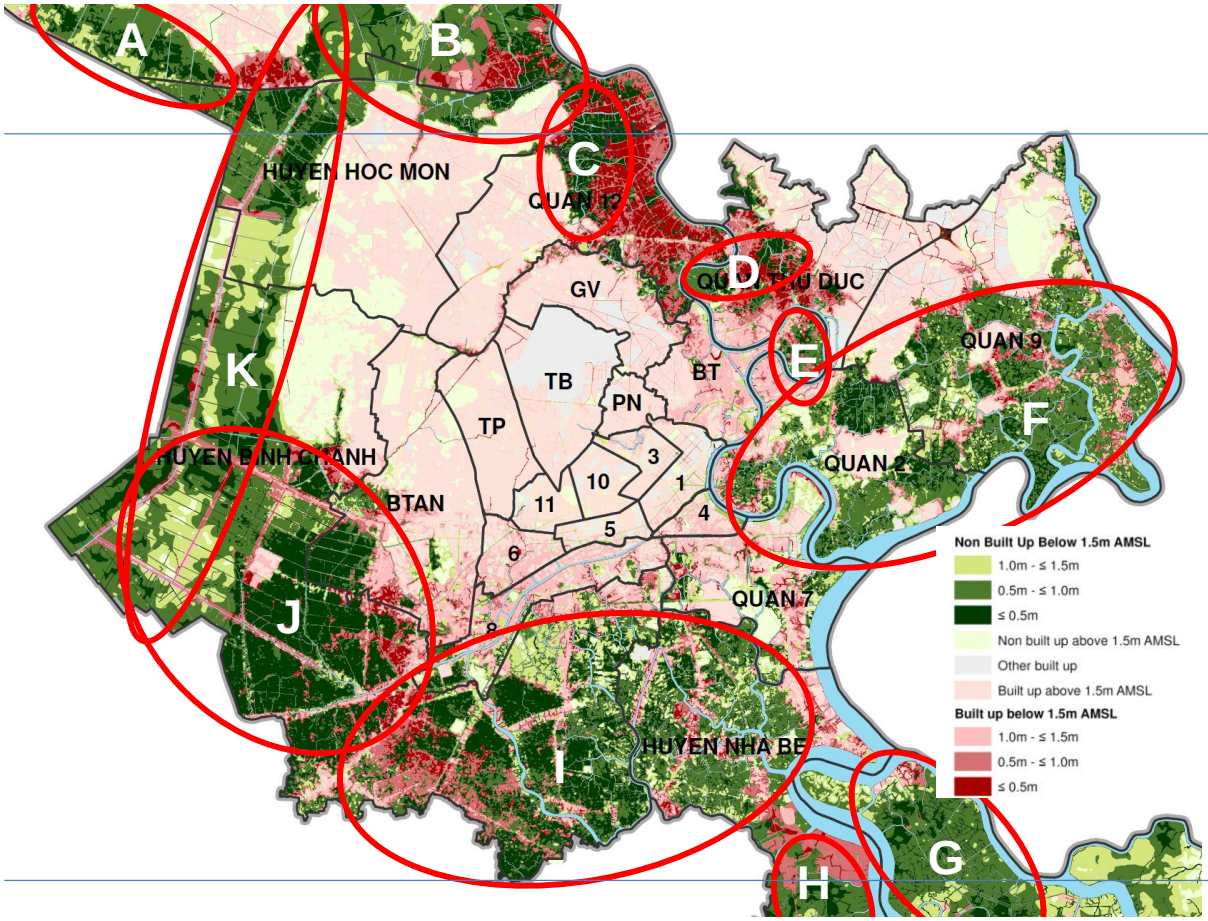


Figure 3.1.1: Low-lying built up areas and non built up areas below 1.5 meters AMSL

Initial Planning Recommendationsfor Urban Floodplain Management (see LUPR ch. 2.4):

The main strategy for land-use planning in HCMC, to reduce future flooding risks to existing built-up areas would be to foremost protect low-lying un-built areas from being converted to land for construction.

There is an urgent need to incorporate at the very minimum an elevation-based flood-risk assessment for current and future planned built-up areas within the land-use planning framework of HCMC.

The zoning of built-up areas should additionally communicate the current flood risk at high-tide level (1.5 m AMSL) to highlight the need for flood protection measures and the important spatial dimension of the risk of flooding for these areas.

The incorporationof a zoning system for the future protection of these un-built areas into the existing system of land-use planning would not only force the future urban development direction to more flood-safe areas, but additionally keep and protect the important areas improving the urban climate and storm-water management in the higher-dense inner city-districts (see Chapters 3.2 and 3.3).

3.2 Planning Recommendations – Urban Storm-Water Management

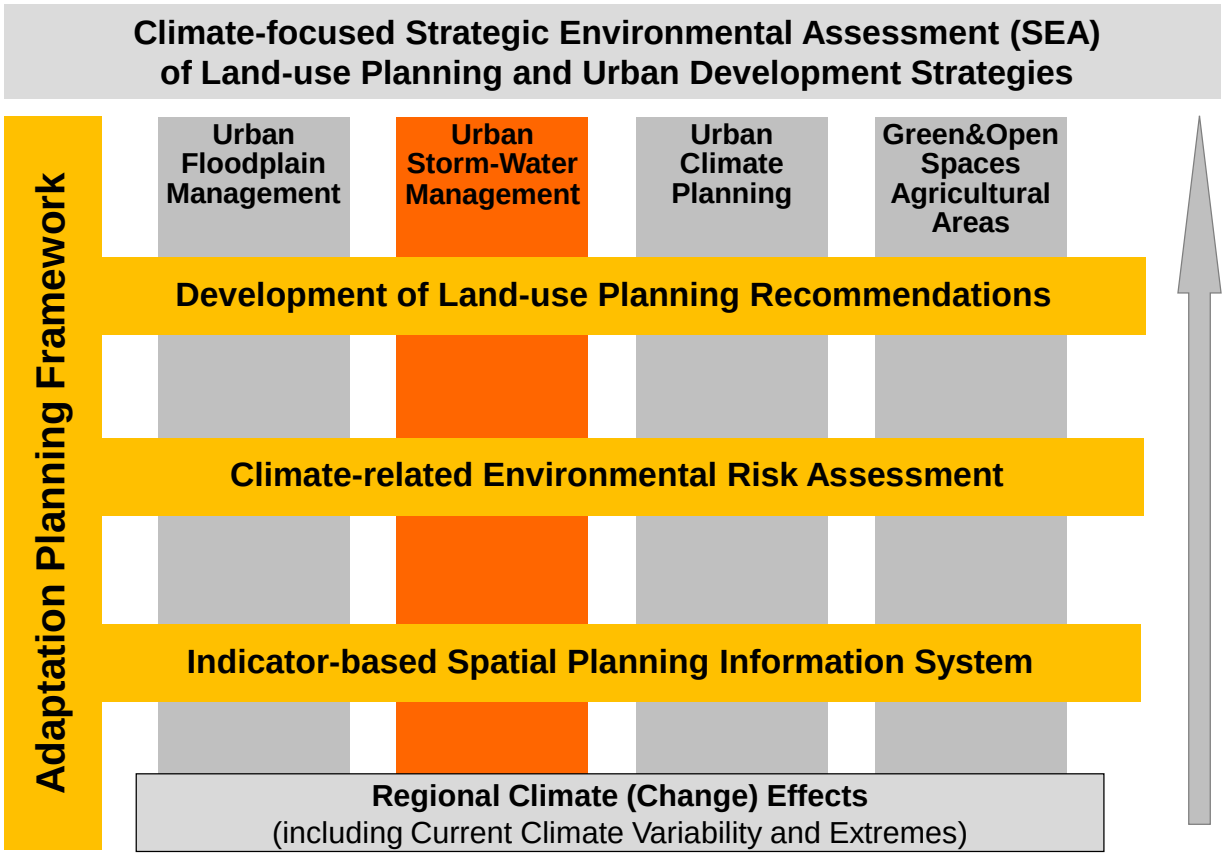


Figure 3.2: Land-use Planning Recommendations – Part: Storm-Water Management

In recent decades, the occurrence of flooding events has become one of the most pressing issues. Since the 1990s, the number of flooded locations, the flooding frequency, and its duration has increased continuously within HCMC. One major cause of this serious problem is the ongoing rapid urbanisation process. The consequences of the current and future flooding events in HCMC are manifold, including: personal injury, direct damage to property, infrastructure and utilities, contamination and disease from flood and sewage waters, loss of income and delayed economic development, break up of communities and social connectivity, blight of land and development, as well as increased insurance costs.

Maintaining the urban water balance and storm-water management requires space. Therefore space for storm-water retention and treatment must be considered within the future land-use planning of HCMC (see LUPR ch. 1.4):

Designation of areas for rainwater treatment into the general land use planning. The preservation of green areas that fulfill multifunctional tasks and are suitable for the retention and treatment of rainwater. For the areas zoned for development within the new land use plan 2025, quality guidelines or standards should be introduced in regards to the degree of sealing or drainage or at the larger scale, the obligation to reserve sufficiently large enough and suitable areas for stormwater management.

3.2.1 Planning Recommendations – Urban Storm-Water Management

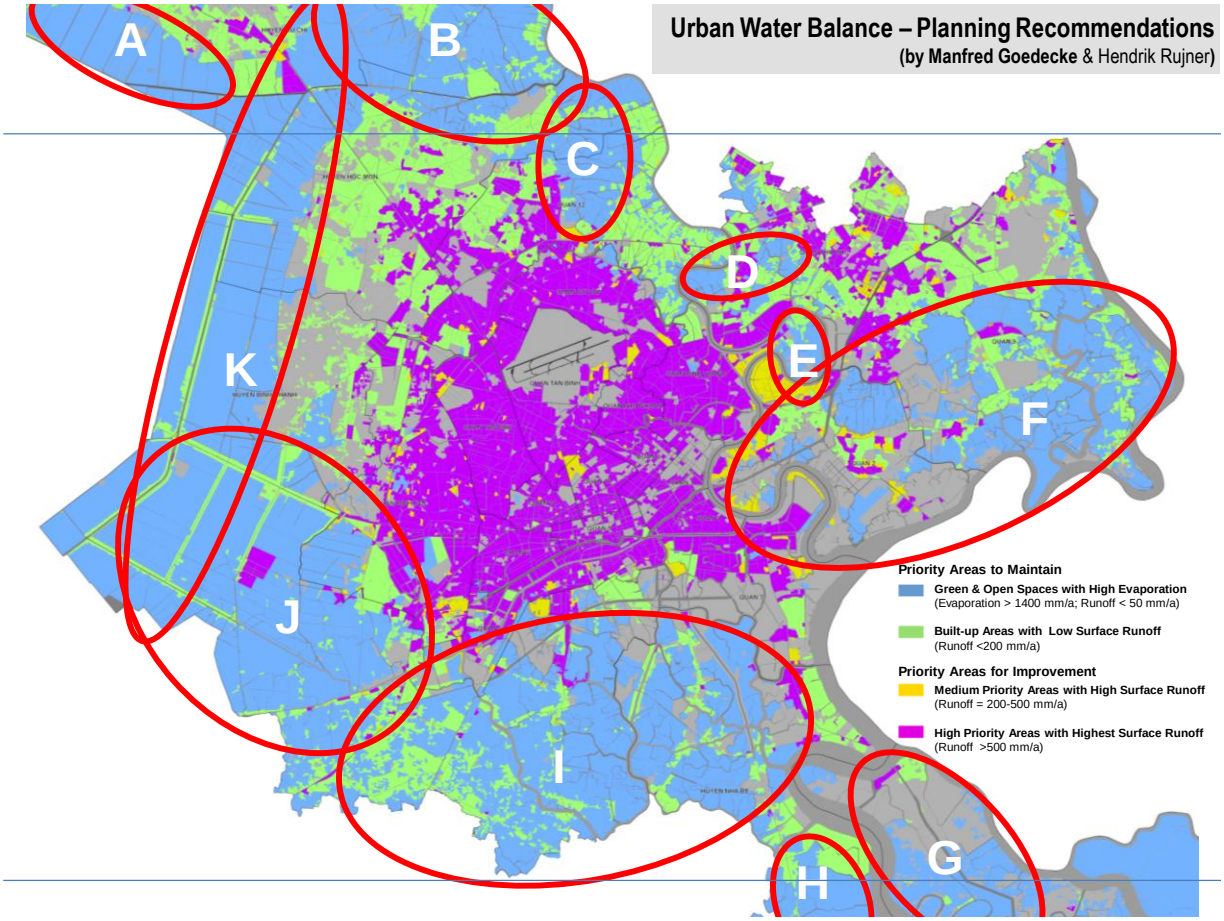


Figure 3.2.1: Maintaining the Urban Water Balance –Planning Recommendations

The compiled Water Planning Recommendation Map classifies HCMC into four main categories based on their runoff, evaporation and infiltration properties (Figure 3.2.1). It must be stated that all existing green and open spaces currently play a very important role in evaporation and infiltration (including groundwater recharge). Furthermore, many of these areas also act as natural retention areas thereby in regulating the HCMC water balance.

Classification	Description	Planning Target
Green & Open Spaces Priority Area to Maintains	Green & Open Spaces with High Evaporation (Evaporation > 1400 mm/a; Runoff < 50 mm/a)	Conserve and protect the existing natural or near-nature water balance - Avoid the development of additional settlement areas at risk from Flooding
Built-up Priority Area to Maintains	Built-up Areas with Low Surface Runoff (Runoff <200 mm/a)	Preserve favourable run-off conditions - Avoid additional intensification of use and sealing - Carry out detailed investigation and analysis on climatic function aspect.

For more specific and detailed planning recommendations for these and other zones please consult the detailed legend in LUPR (Table 1.6).

3.3 Planning Recommendations – Urban Climate Planning

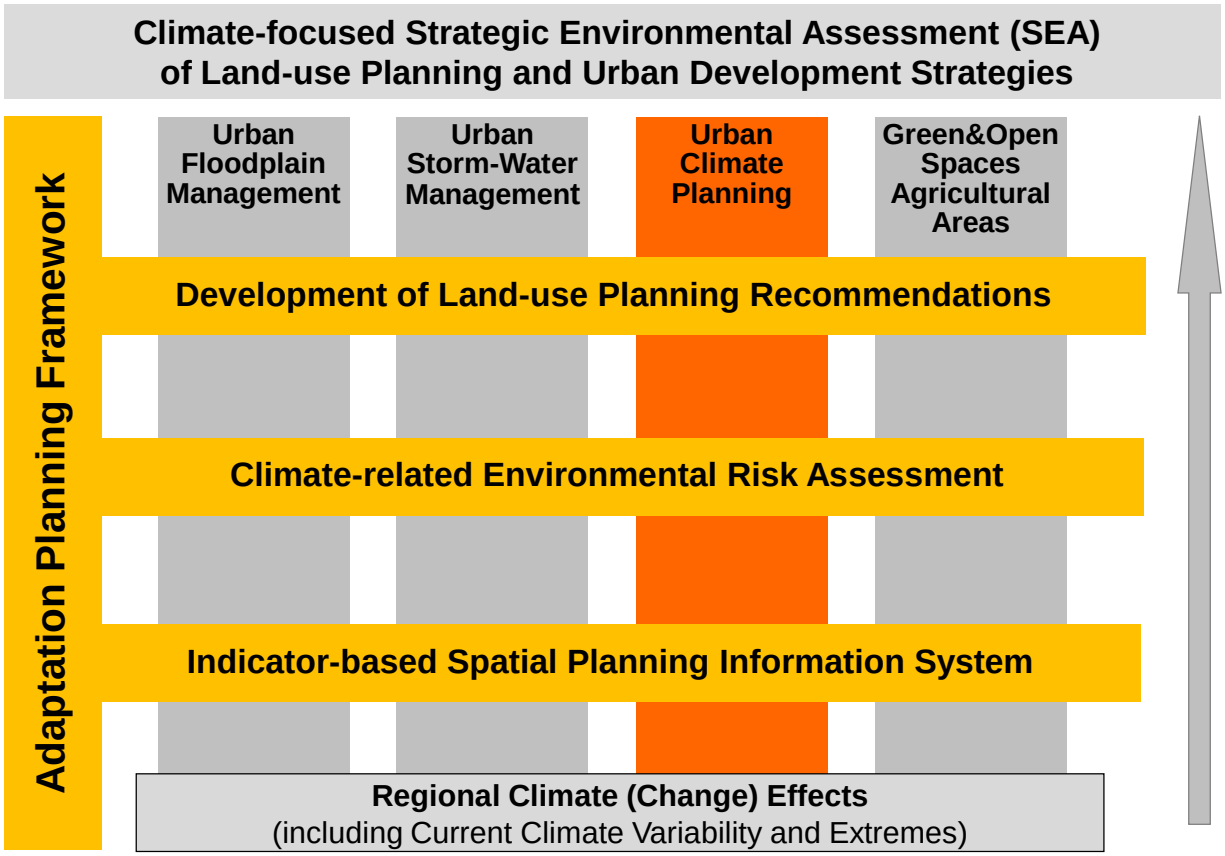


Figure 3.3: Development of Land-use Planning Recommendations – Part Urban Climate Planning

The Urban Climatic Map (UCM) is considered as an essential tool to translate climatic knowledge into urban planning process in HCMC. With the assistance of UCM, it is believed that planners and architects can better understand and evaluate the effect of urban planning and building design on the microclimate of surrounding environment. The climatic issues concerned include urban air ventilation, thermal comfort and urban heat island effect.

The Urban Climatic Analysis Map and Urban Climatic Planning Recommendations have done a strategic and comprehensive analysis for Ho Chi Minh City and are an important tool of the urban climatic conditions as a whole (see LUPR ch. 3.3). The UCM is for the improvement of urban climatic conditions of the territory in general and the sensitive areas in particular. Based on that key planning recommendations for the Urban Climatic Planning Zones could be formulated. The UCM of HCMC is planning activity-oriented. It provides a strategic urban climatic information platform and planning framework upon which urban climatic considerations can be taken into account at the strategic and district planning level.

Based on the analysis obtained from the urban climatic investigation, climatic zones and air paths could be developed and recommendations derived.

3.3.1 Planning Recommendations – Urban Climate Planning

Figure 3.3.1: Urban Climate Map with Planning Recommendation Zones

The developed Urban Climate Map includes six basic categories for planning orientation, as can be seen in the UCM-legend (Figure 3.3.1). In general all existing green and open spaces around the dense built-up urban districts are important fresh and cold air production zones The general recommendations for green and open spaces are shown in the following table.

Classification	Climate description	Evaluation
1 Fresh & cool air production zones	Open areas with significant climatic activity, cool and fresh air production,climatically active open sites in direct relation to the housing area, in combination to slopes very effective.	High sensitivity with respect to intervention which changes in land use. Do not allow increasing the surface roughness (e.g. no further constructions or buildings). Keep open of cold / fresh air stream, Minimize the existing barrier on the air streams. The air movement connections must be fully analyzed and understood including the source of the air stream channels, which may be far away from the concerning area.
2 Cool air production zones	Open areas with less significant climatic activity, fresh air production.	The increasing surface roughness (e.g. further constructions or buildings) can only be allowed if they respect slope winds and thermal induced circulation pattern, furthermore, redevelopments should be allowed only in exception case, which is supported by detailed investigation and analyze on climatic function aspect.

More specific planning recommendations for the delineated Climatic Districts A to E and V (black letters in the Urban Climate Map) are given in the detailed legend in LUPR (Table 3.4).

3.4 Planning Recommendations – Protection of Low-lying Open Spaces

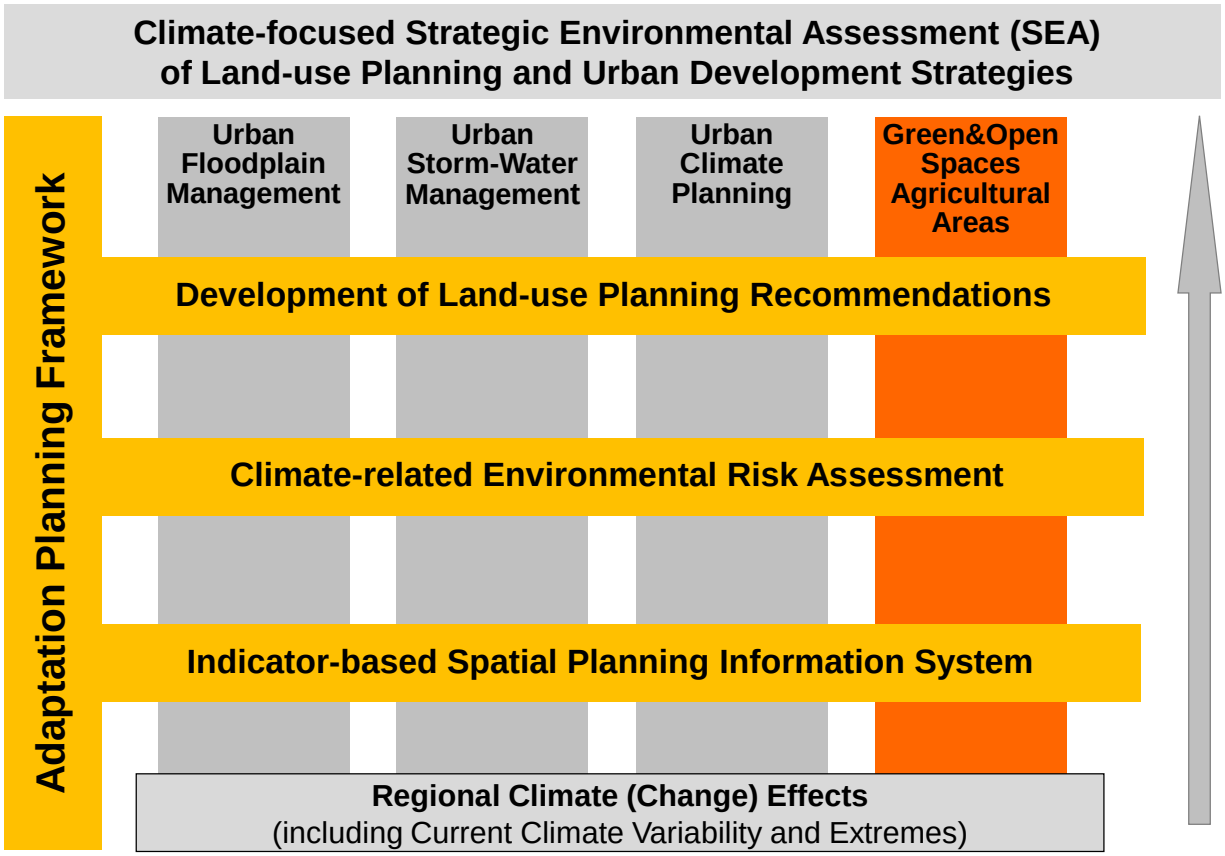


Figure 3.4: Land-use Planning Recommendations – Part Green and Open Spaces

According to DONRE, by the year 2025, on the basis of the current HCMC urban development master plan, the available agricultural land (121,000 ha in 2008, ca. 58% of the total area) will reduce to 83,000 ha, with 38,000 ha rezoned as construction land and becoming available for new developments. Alongside this ongoing urbanisation, comes the loss or deterioration of the valuable surrounding multi-functional green and open spaces, which are not only important for agricultural production but also for the regulation of both the urban climate and urban water balance (see LUPR ch. 5.3).

Planning for risk and uncertainty for future urban growth will not just be a challenge for high flood prone areas; it will be a broader challenge impacting on the nature and location of future urban development, particularly in planning for climate change. There is a strong correlation between the urban vulnerability and physical exposure. Here land-use planning that takes into account disaster risks is the single most important adaptation measure for minimising future disaster losses. The spatial planning framework and subsequent urban planning decisions, as currently applied, do not attach sufficient importance to physical exposure and the rate of urban growth being associated with the risk of disaster losses. Urban growth does not increase exposure of population to risks per se. In general, urban governments are responsible for regulating either building or development in a way that reduces risks.

3.4.1 Planning Recommendations – Protection of Low-lying Open Spaces

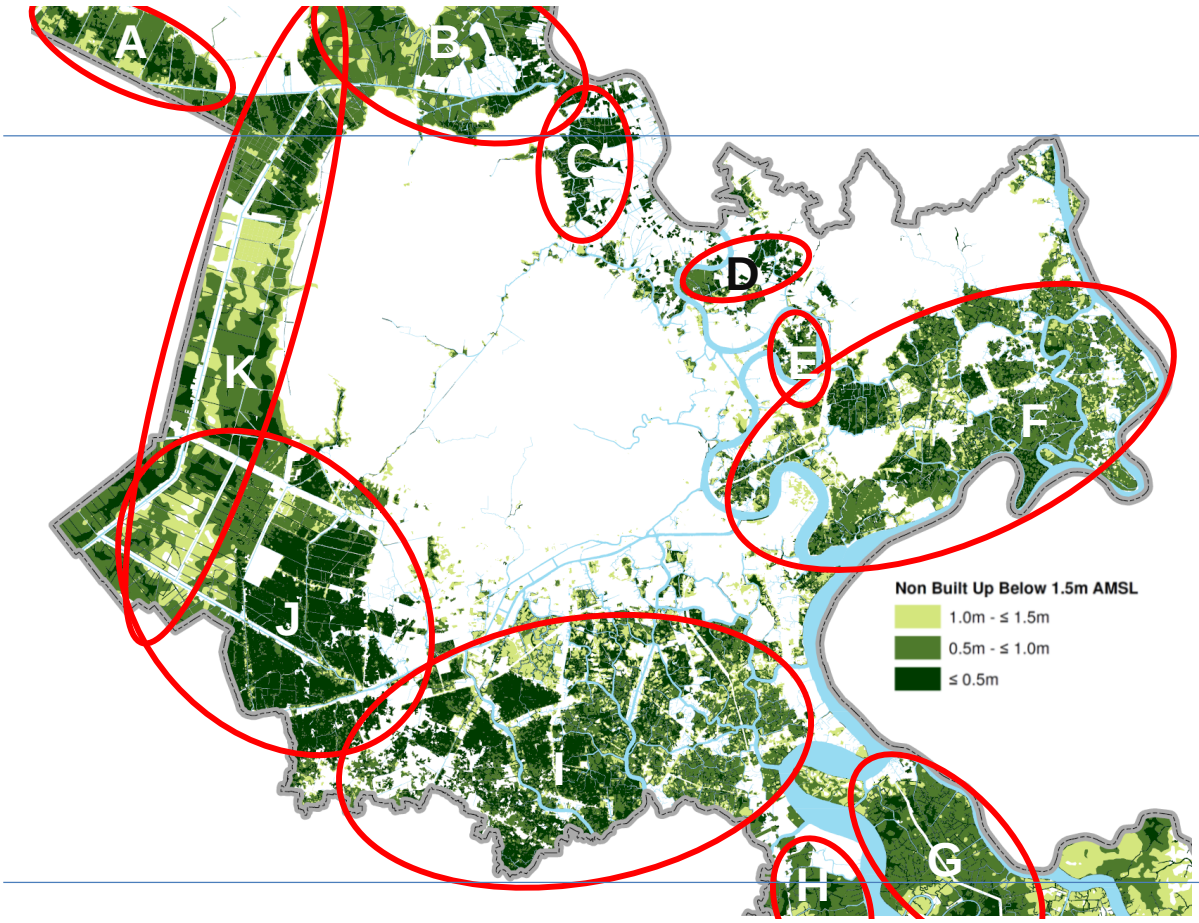


Figure 3.4.1: Green and Open Spaces- Agricultural land below high-tide-level 1.5 m AMSL

The above map highlights well that the current urban form and structure of HCMC is strongly influenced and to some extent constrained by its surrounding natural conditions. The few remaining open spaces surrounding the extremely dense core – mainly agricultural land – can be seen to have elevation of below the current high-tide level of 1.5 m AMSL (Figure 3.4.1). These spaces act as a natural blue and green belt – akin to flood risk zoning by nature – and strongly influences the ongoing inner-city re-densification. Hence an understanding of the interrelationship between urban densification and adaptation processes to current flood risk can guide the spatial adaptation processes of HCMC in the uncertain times of rapid urban growth and climate change.

At the same time, a larger percentage of blue and green infrastructure is in general beneficial to adaptation. It provides room for urban open spaces, urban agriculture and natural spaces for retention of storm and flood water management (Chapter 3.1& 3.2)areas to generate and transit cool and fresh air lowering and offsetting the energy demands for cooling in tropical climates (Chapter 3.3).

Urban development strategies need to reconcile both goals – mitigation and adaptation - to be really climate resilient.

Map References

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